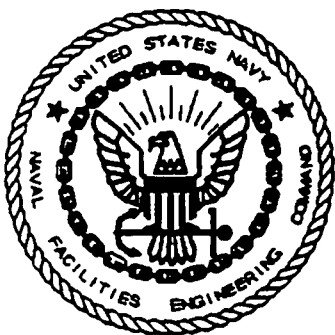


**VOLUNTARY CORRECTIVE ACTION WORK PLAN
RCRA FACILITY INVESTIGATION
NAVAL SUPPORT ACTIVITY MEMPHIS
MILLINGTON, TENNESSEE**



**SWMU 16
N-94 ABOVEGROUND WASTE STORAGE TANKS
TANK AND SOIL REMOVAL**

Revision: 02

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**CTO-094
Contract No. N62467-89-D-0318**

Prepared for:

**Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina**

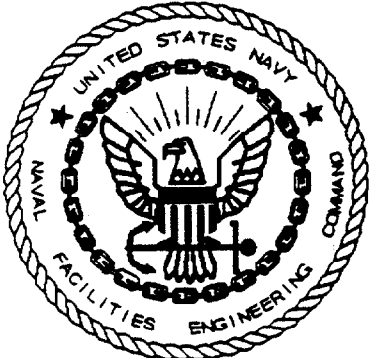


Prepared by:

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(901) 372-7962**

April 27, 1998

**VOLUNTARY CORRECTIVE ACTION WORK PLAN
RCRA FACILITY INVESTIGATION
NAVAL SUPPORT ACTIVITY MEMPHIS
MILLINGTON, TENNESSEE**



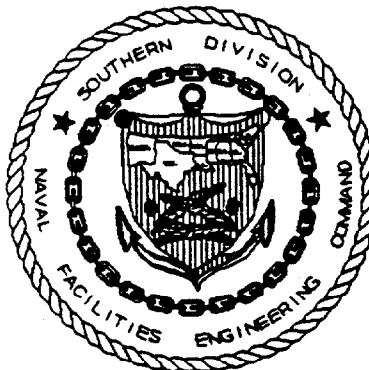
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The Contractor, EnSafe Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.

**Date: April 27, 1998
Signature: Lawson Anderson
Name: Lawson Anderson
Title: Task Order Manager**

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Appendix D	Site-Specific Health and Safety Plan

1.0 INTRODUCTION

As part of the U.S. Navy Installation Restoration Program, the following Resource Conservation and Recovery Act (RCRA) Voluntary Corrective Action Work Plan has been prepared for the removal of tanks and soil at Solid Waste Management Unit (SWMU) 16, the N-94 Aboveground Waste Storage Tanks, at Naval Support Activity (NSA) Memphis, Millington, Tennessee (Figure 1). The primary references for this work plan are the *Comprehensive RCRA Facility Investigation [RFI] Work Plan* (E/A&H, 1994), the *RCRA Facility Assessment* (ERC/EDGE, 1990), and the *Assembly D Site Investigation Plan — SWMU 16, N-94 Aboveground Waste Storage Tanks*, Revision 2 (E/A&H, 1997).

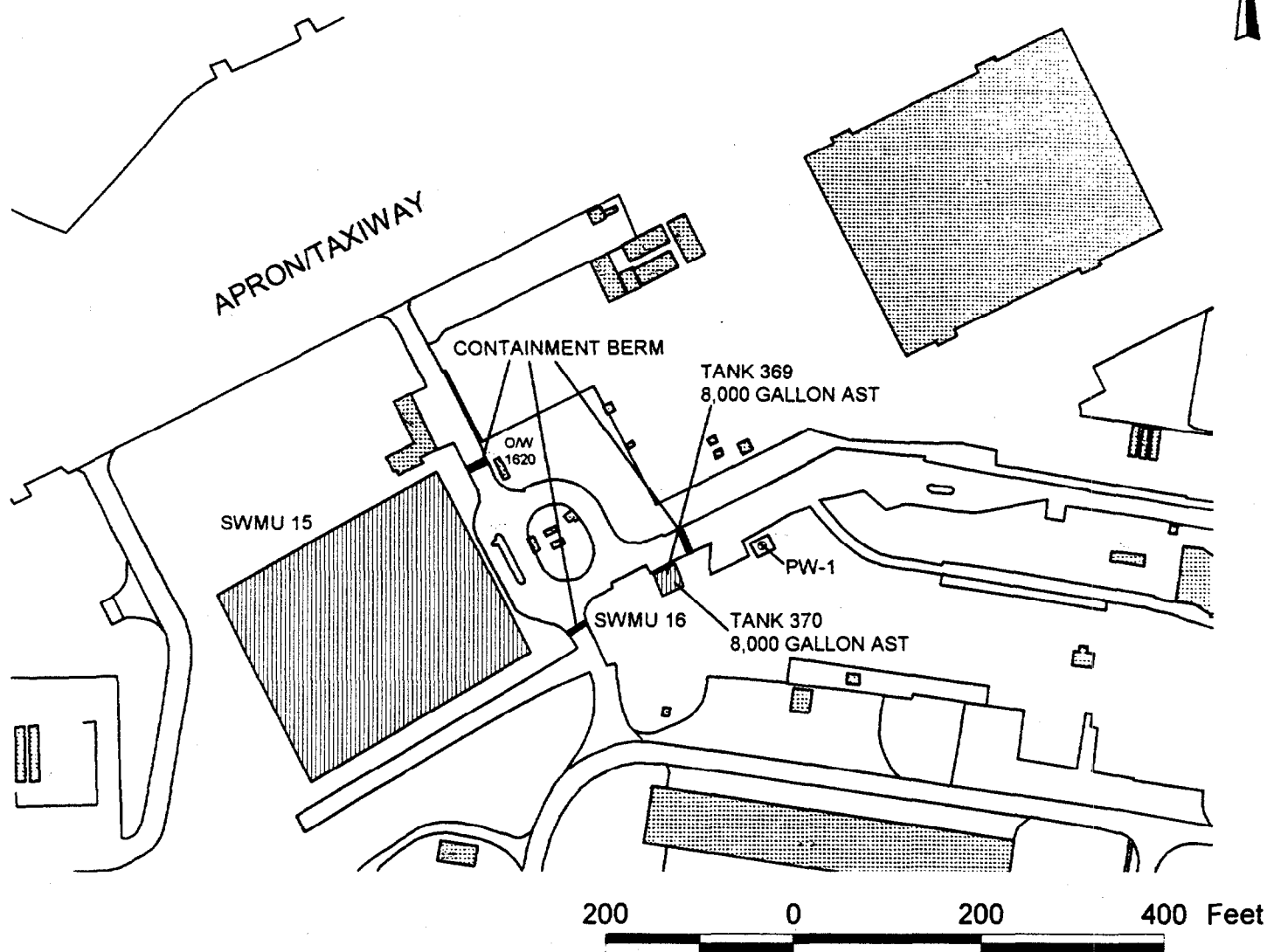
2.0 ENVIRONMENTAL SETTING

SWMU 16 consists of two 8,000-gallon aboveground waste storage tanks (ASTs) located approximately 900 feet east of the main runway and 300 feet northwest of Building N-16 on the NSA Memphis Northside. Figure 1 is a vicinity map of SWMU 16.

The two waste tanks (Tanks 369 and 370) reportedly were installed in 1962 and are scheduled for removal in 1998. The tanks were used to store petroleum products, waste fuels, and/or waste lubricating oil. Currently, Tank 369 contains waste oil and Tank 370 contains aviation gas and JP-5. Neither the tanks nor fill pipe area have an immediate secondary containment system; however, SWMU 16 is part of a larger area surrounded by a concrete berm which drains to an oil-water separator approximately 350 feet northwest of SWMU 16 (Figure 1). The concrete berm directs any water runoff or free-flowing product spills within SWMU 16 to the oil-water separator. A concrete road is adjacent to the north side of SWMU 16, while the south and east sides are bordered by grass areas, and the west side is bordered by an area covered with gravel. Petroleum staining is presently visible in the adjacent grass and gravel areas. The *Visual Site Inspection* (ERC/EDGE, 1990a) report did not indicate a release at SWMU 16.

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FIGURE 1
VICINITY MAP
SWMU 16

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According to the *RCRA Facility Assessment* (RFA) (ERC/EDGE, 1990b), representatives of the U.S. Navy, Tennessee Department of Environment and Conservation (TDEC), and U.S. Environmental Protection Agency (USEPA) Region IV recommended no further action at this SWMU. Because SWMU 16 is located on property to be transferred from the Navy to the City of Millington, it was later recommended for a Confirmatory Sampling Investigation (CSI) by the BRAC Cleanup Team. On April 10, 1995, EnSafe/Allen & Hoshall (E/A&H) personnel noted a leaking pipe fitting that was causing petroleum stains on the gravel and on a small portion of unpaved ground under the fill pipe assembly. The leak was immediately repaired by Navy personnel.

2.1 Topography and Drainage

The topography at SWMU 16 generally is level. Surface water drains into an oil-water separator approximately 350 feet northwest of SWMU 16. Water from the oil-water separator discharges into the NSA Memphis sanitary sewer system.

2.2 Geologic and Hydrogeologic Information

The regional hydrogeology of the Memphis area is detailed in Section 2.11; a conceptual model of the hydrogeology at NSA Memphis is presented in Section 2.12 of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Updated information is available in the *Hydrogeology and Groundwater Quality at Naval Support Activity Memphis, Millington, Tennessee* (Carmichael and others, 1997).

2.2.1 Site-Specific Geology

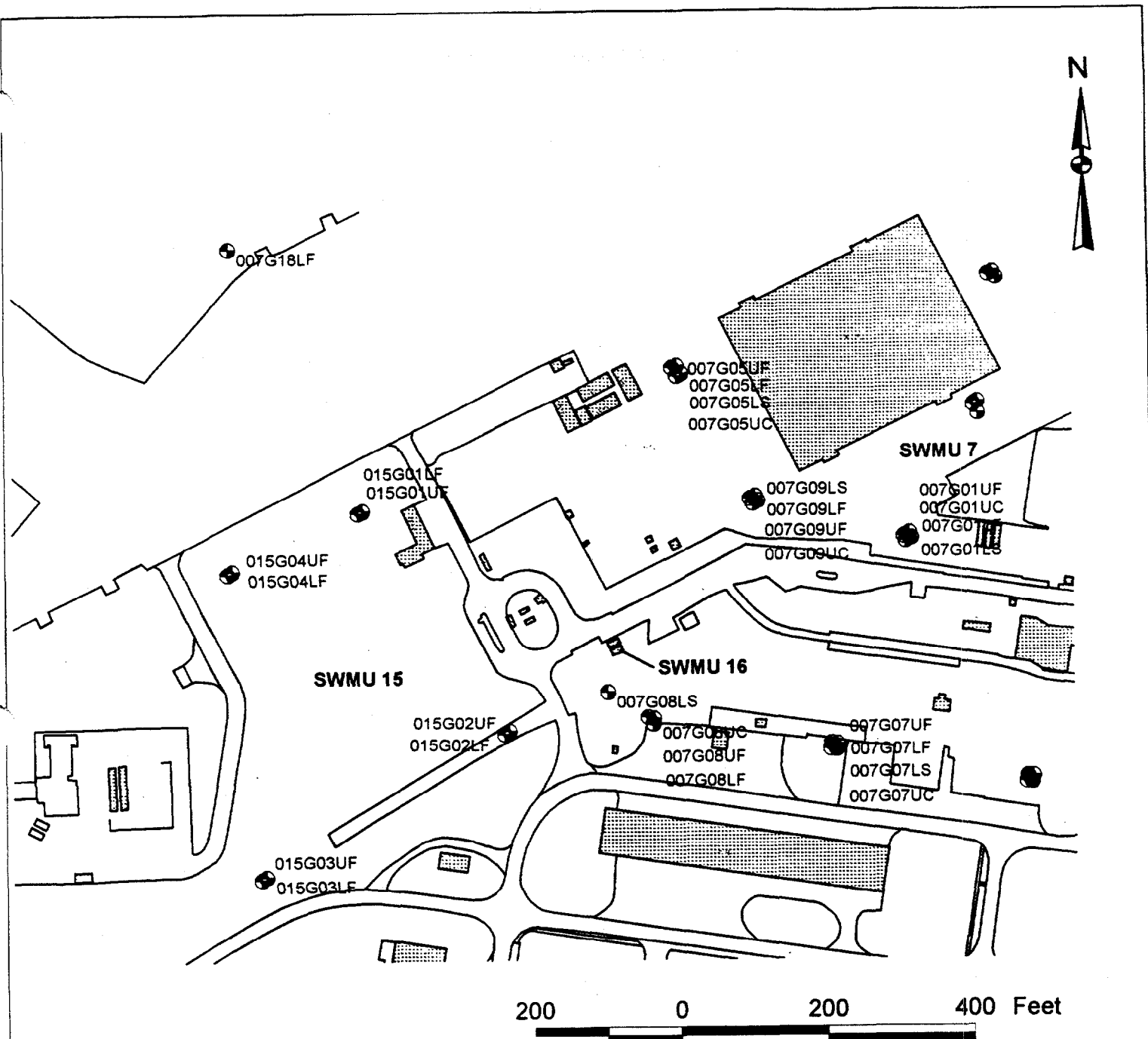
No previous geologic investigations have been conducted at SWMU 16. However, site-specific geology has been characterized using data from RFI work at SWMU 15 to the west of SWMU 16 (see Figure 1), including lithologic descriptions and geophysical logging during RFI soil-boring activities. Lithologic information to the north and east of SWMU 15 was also obtained from

multiple borings in the SWMU 7 area. The following describes the stratigraphy identified beneath the SWMUs 7 and 15 areas.

Loess, the surficial material in the area, is characterized as a silt varying in clay content and color from ground surface to depths of 28 to 42 feet. Color ranges from brown, yellowish brown, and reddish brown to olive-gray and greenish gray. At SWMU 15, a saturated zone was encountered in the loess between 11 and 23 feet below ground surface (bgs) at several soil-sampling locations. However, a water-bearing zone was absent at other locations in the SWMU 7 and 15 areas, particularly in those areas covered by concrete or asphalt.

The first presence of sand marks the contact between the loess and the underlying fluvial deposits. This contact was visually identified during RFI soil-boring activities at SWMU 15 and confirmed through geophysical logging at monitoring well location 015G03LF (Figure 2). The fluvial deposits, which are between 43 and 68 feet thick in the SWMU 15 area, terminate between 85 to 96 feet bgs. The uppermost part of the fluvial deposits consists of silty and clayey, very fine- to medium-grained sand which generally coarsens with depth to a medium- to coarse-grained sand with pea-sized gravel between 55 and 63 feet bgs. A sequence of gravelly sand or sandy gravel then extends to the base of the fluvial deposits. The gravel is rounded to subangular, and generally coarsens with depth, with some pieces collected in samples from near the base of the fluvial deposits exhibiting a maximum longitudinal diameter of 2 inches. The fluvial deposits are saturated. Sediments in this unit are brown, yellowish brown, dusky yellow, yellowish orange, yellowish gray, reddish brown, light gray, and olive gray.

The contact between the fluvial deposits and the underlying Cockfield Formation is erosional and ranges from about 85 to 96 feet bgs in the SWMU 15 area. This contact was noted by a change from sand and gravel to fine sand with clay, either interstitial, or in thin laminations. Sediment color in the Cockfield Formation varied between soil borings, from light gray, to yellowish gray,



LEGEND



Monitoring Well



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FIGURE 2
Monitoring Well Locations
SWMU 16

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olive-gray, yellowish orange, and reddish brown. The contact between the fluvial deposits and the Cockfield Formation generally was encountered at shallower depths at SWMU 7, east of SWMU 15, except in the boring for well 007G18LF, located north of SWMU 15 (Figure 2), where the contact was identified at approximately 100 feet bgs. Appendix A includes copies of selected boring logs, geophysical logs, and geotechnical information from SWMUs 7 and 15.

2.2.2 Site-Specific Hydrogeology

Groundwater in the fluvial deposits flows locally toward the northwest, based on data collected during investigations at Assembly A SWMUs, communication with U.S. Geological Survey (USGS) representatives, and data obtained during the SWMU 15 CSI and RFI. Groundwater flows primarily downward in the loess, although some loess groundwater may discharge locally to nearby streams, drainage ditches, and other surface-water bodies. Specific information from a direct push technology (DPT) investigation conducted during the SWMU 15 CSI and from monitoring-well installations conducted during the SWMU 15 and SWMU 7 RFIs is presented below.

Hydrocone Investigation

During the DPT investigation conducted as part of the SWMU 15 CSI, a Hydrocone groundwater sampler was used. Electronic equipment in the tool and uphole recorded the tool fill rate and hydrostatic pressure at specific depths in the loess and upper fluvial deposits. Horizontal hydraulic conductivity of the sample zones was estimated by applying the fill rate data to the Bouwer and Rice rate-of-rise permeability model (Bouwer and Rice, 1976). Horizontal hydraulic conductivity measurements for the loess ranged from 1.09×10^{-5} to 2.27×10^{-4} centimeters per second (cm/sec). Measurements for the fluvial deposits ranged from 1.05×10^{-5} to 3.92×10^{-4} cm/sec.

Monitoring Well Investigation

During the SWMU 15 RFI, four monitoring well pairs were installed. Each pair consisted of one well each screened in the upper and lower parts of the fluvial deposits. Groundwater elevations were measured in each well on April 8, 1996, to determine flow directions and gradients in the upper and lower fluvial deposits at SWMU 15. Potentiometric maps of the two zones indicate a northwest flow for groundwater in the upper fluvial deposits and a northwest to west-northwest flow in the lower fluvial deposits. Only slight head difference exists between groundwater levels in the upper and lower fluvial deposits monitoring wells. Horizontal groundwater gradients in the respective zones range from 0.0032 feet/foot for the upper fluvial deposits to 0.0042 feet/foot in the lower fluvial deposits.

Estimations of the vertical hydraulic conductivity in the loess and fluvial deposits were obtained from Shelby tube samples collected during the Assembly A RFI for SWMU 7. Falling head permeability tests were conducted on a sample from the lower part of the fluvial deposits collected from the boring for monitoring well 007001LF and a sample of loess from the boring for well 007G09LS (Figure 2). The sample from the lower fluvial deposits had a vertical hydraulic conductivity of 6.8×10^{-5} cm/sec and the value for the loess sample was 9.5×10^{-7} cm/sec.

2.3 Climatological Data

Regional climatological data are provided in Section 2.8 of the Comprehensive RFI Work Plan.

3.0 SOURCE CHARACTERIZATION

The two waste tanks at SWMU 16 have been used to store a variety of liquids including petroleum products, waste fuels, and/or waste lubricating oil. Spent solvents also may have been mixed with the waste fuels or oils. The potential contaminants of concern at SWMU 15 are jet fuel

constituents (benzene, toluene, ethylbenzene, xylene, and naphthalene), chlorinated solvents, semivolatile hydrocarbon constituents of oils, and metals.

A CSI was conducted at SWMU 16 in July 1997 to assess the nature of surface and subsurface soil contamination, determine the contaminants of concern, and estimate the extent of shallow soil contamination, in the event that a soil removal is warranted. The CSI work plan and sampling results are presented in Sections 4.2 and 4.3.

4.0 CHARACTERIZATION OF HAZARDOUS CONSTITUENT RELEASES

4.1 Previous Investigations

A 1990 visual inspection of SWMU 16 did not indicate surface releases. According to the 1990 RFA, the tanks were equipped with secondary containment systems. On April 10, 1995, an E/A&H representative inspected SWMU 16 and no secondary containment system was observed immediately around the tanks; however, a concrete berm surrounded the larger area which included SWMU 16. Also on this date, a leak of hydrocarbons from a fitting in the piping assembly was discovered that had stained the gravel and a small unpaved area under the piping assembly. The leak was immediately repaired by Navy personnel. No other previous investigations are known to have been conducted at SWMU 16.

4.2 SWMU 16 CSI

In all, 14 shallow soil samples were collected from seven locations around SWMU 16 and analyzed during the July 1997 CSI.

4.2.1 CSI Objectives

The SWMU 16 investigation focused on the following objectives:

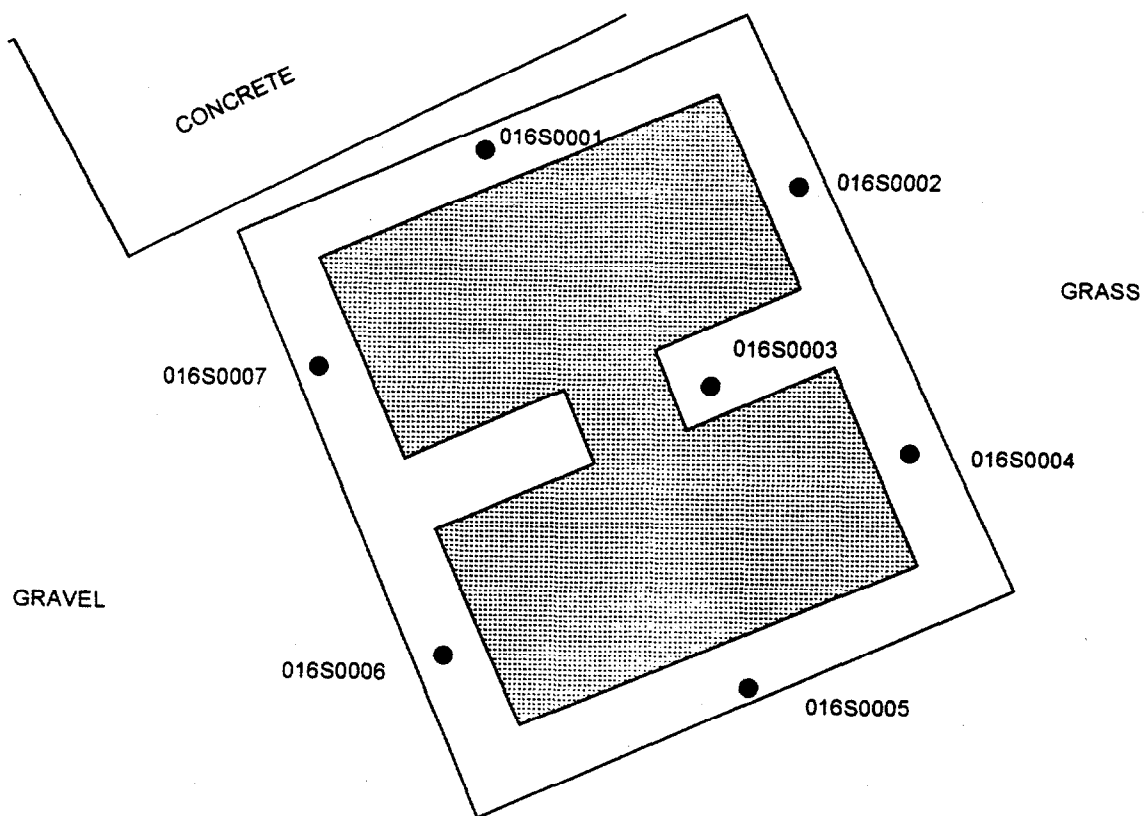
- Investigate the nature of surface and subsurface soil contamination associated with the two waste tanks.
- Estimate the extent of shallow contaminated soil that might have to be excavated when tanks 369 and 370 were removed.
- Investigate potential health risks associated with any identified surface-soil contamination.

4.2.2 Sampling

The CSI consisted of hand-auger sampling (as outlined in Section 4.4.4.3 of the Comprehensive RFI Work Plan) for laboratory analysis. Fourteen shallow soil samples were collected from seven locations (Figure 3) around the tanks. At each location, an upper-interval surface sample was collected from 0 to 1 feet bgs and a lower-interval subsurface sample was collected from 3 to 4 feet bgs. Field selection of the final sample locations was biased toward areas of any visibly stained soil.

4.2.3 Analytical Procedures and Parameters

Field measurements at SWMU 16, which were made in accordance with Section 4.10 of the Comprehensive RFI Work Plan, consisted of headspace analysis (organic vapor detection) for all soil samples using a photoionization detector (PID). The PID readings in the 3- to 4-foot interval were used to determine if deeper samples were needed. Based on the PID readings and visual observations of these samples, no samples deeper than 4 feet were collected.



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FIGURE 3
SAMPLE LOCATION MAP
SWMU 16

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All soil samples were submitted to an offsite laboratory for analysis. Upper-interval samples from the southwest end of each tank (sample locations 016S0006 and 016S0007), near the tank piping, had full scan analyses (FSA) performed to determine the nature of SWMU 16 soil contamination and provide data for a preliminary risk evaluation (FSA methods are listed below). Lower-interval samples from locations 016S0001 and 016S0002 had FSA, minus pesticide, herbicide, PCB, and cyanide analyses (see Table 1 for specific methods to be performed). The remaining sample locations adjacent to and between the tanks were selected to estimate the extent of shallow subsurface contamination using total petroleum hydrocarbons (TPH) as an indicator parameter, and to determine whether a soil removal would be necessary.

The following methods were used for the FSA samples:

- Volatile organic compounds (VOCs), USEPA Method 8240
- Semivolatile organic compounds (SVOCs), USEPA Method 8270
- TPH, USEPA Method 418.1
- TPH-gasoline range organics (TPH-GRO), Tennessee (TN) Modified 8015/GRO
- TPH-diesel range organics (TPH-DRO), TN Modified 8015/DRO
- Chlorinated pesticides/polychlorinated biphenyls (PCBs), USEPA Method 8080
- Organophosphorus pesticides, USEPA Method 8140
- Chlorinated herbicides, USEPA Method 8150
- RCRA Part 264, Appendix IX Total Metals, USEPA Method 6010/7000 series
- Total cyanide, USEPA Method 9010

Table 1 lists the soil samples collected and the analyses performed.

Table 1
Sample Analytical Parameters — SWMU 16

Sample Number	Sample Depth	Analyses	Rationale
016S000601, 016S000701	Upper interval 0 to 1 foot	FSA ^a	Risk assessment purposes, nature of contaminants, and estimate volume of soil for possible removal.
016S000101, 016S000201, 016S000301, 016S000401, 016S000501, 016C000501 ^b	Upper interval 0 to 1 foot	TPH, TPH-GRO, and TPH-DRO	Estimate volume of soil for possible removal.
016S000104, 016S000204	Lower interval 3 to 4 feet	VOC, SVOC, TPH, TPH-GRO, TPH-DRO, and Appendix IX Metals	Nature of contaminants and estimate volume of soil for possible removal.
016S000304, 016S000404, 016S000504, 016S000604, 016C000604 ^b , 016S000704	Lower interval 3 to 4 feet	TPH, TPH-GRO, and TPH-DRO	Estimate volume of soil for possible removal.

Notes:

^a = FSA includes analysis for VOC, SVOC, TPH, TPH-DRO, TPH-GRO, chlorinated pesticides/PCBs, organophosphorus pesticides, chlorinated herbicides, total metals (Appendix IX), and cyanide.

^b = 016C000501 and 016C000604 are duplicates of 016S000501 and 016S000604, respectively.

4.2.4 Sample Management

Samples were managed as specified in Sections 4.12 and 5 of the Comprehensive RFI Work Plan.

4.2.5 Sample Custody

Sample custody procedures outlined in Section 4.12.5 of the Comprehensive RFI Work Plan were followed during the CSI.

4.2.6 Quality Assurance/Quality Control

Quality assurance/quality control procedures outlined in Section 4.14 of the Comprehensive RFI Work Plan were followed during the CSI.

4.2.7 Decontamination Procedures

Decontamination procedures outlined in Section 4.11 of the Comprehensive RFI Work Plan were followed during the CSI.

4.2.8 Investigation-Derived Waste

Investigation-derived waste (IDW) was handled as specified in Section 4.13 of the Comprehensive RFI Work Plan and in the *NSA Memphis IDW Management Plan* (E/A&H, 1995).

4.3 SWMU 16 CSI Results

Appendix IX metals, herbicides, pesticides, SVOCs, and TPH were identified during the CSI in surface and subsurface soil at SWMU 16. Inorganic constituents identified in soil at SWMU 16 were compared to background soil concentrations to determine whether measured values occur naturally or indicate contamination. The procedures used to determine the background reference concentrations for inorganics are documented in the technical memorandum *Reference Concentrations* (E/A&H, 1997). Except for TPH, concentrations of organic contaminants were compared to USEPA industrial risk-based concentration (RBC) values (USEPA, 1997).

Tables 2 through 5 summarize the analytical data collected during the CSI and present RBC and background reference concentrations for comparison. Table 6 presents TPH data for which there are no RBC values or background reference concentrations. For SWMU 16 data, the tables present concentrations that exceed detection limits only. A complete copy of the laboratory data is presented in Appendix B.

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Table 2
 Appendix 9 Metals in Soil (Hits Only) (mg/kg)

Parameter	Subsurface Samples		Subsurface Background Reference Concentration	Surface Samples		Surface Background Reference Concentration
	016S000104	016S000204		016S000601	016S000701	
Arsenic	12.1	11	20.3	11.8	62.1	14.6
Barium	187	233	265	182	139	223
Beryllium	1.3	0.32 J	1.00	0.56 J	0.5 J	1
Chromium	16.5	12.2	28.3	17.1	12.5	23.9
Cobalt	19.1	10	14.4	9	8.4	16.0
Copper	23.4	16	32.5	19	17.3	24.2
Lead	16.9	14.3	19.8	26.8	20.2	26.0
Mercury	0.05	ND	0.18	0.03	0.03	0.46
Nickel	36.3	13.3	NA	16	16	20.6
Thallium	0.26 J	0.18 J	NA	0.31 J	0.16 J	NA
Vanadium	33.8	21.9	43.7	32.2	24.4	45.1
Zinc	75.6 J	49.7 J	109	58 J	61.4 J	98.0

Notes:

J = Estimated concentration

NA = Not available

ND = Not detected

The metals antimony, cadmium, selenium, and silver were not detected in the samples.

Table 3
Herbicides in Soil (Hits Only) ($\mu\text{g}/\text{kg}$)

Parameter	016S000701	RBCs
Dicamba	5.3 J	61,000,000
MCPP	6000	2,000,000

Note:

J = Estimated concentration
RBC = Risk-based concentrations

Table 4
Pesticides in Soil (Hits Only) ($\mu\text{g}/\text{kg}$)

Parameter	016S000601	016S000701	RBCs
Endosulfan I	0.97 J	1.2 J	12,000,000
Dieldrin	8.2	7.1	360
Methoxychlor	1.2 J	ND	10,000
Chlordane	4.5 J	6.2 J	4,400

Notes:

ND = Not detected
J = Estimated concentration
RBC = Risk-based concentration

Table 5
SVOCs in Soil (Hits Only) ($\mu\text{g}/\text{kg}$)

Parameter	016S000104	016S000204	016S000701	RBCs
Di-n-butylphthalate	51 J	ND	ND	200,000,000
Fluoranthene	ND	ND	26 J	82,000,000
Pyrene	ND	8.6 J	19 J	61,000,000

Notes:

ND = Not detected
J = Estimated concentration
RBC = Risk-based concentration

Table 6
TPH in Soil (mg/kg)

Upper-Interval Samples (0 to 1 foot bgs)

Sample Number	TPH	TPH-DRO	TPH-GRO
016S000101	ND	5.4	ND
016S000201	990	510	ND
016S000301	26	5.3	ND
016S000401	140	ND	ND
016S000501	20	ND	ND
016S000601	44	5	ND
016S000701	18	5.4	ND

Lower-Interval Samples (3 to 4 feet bgs)

016S000104	ND	ND	ND
016S000204	300	39	ND
016S000304	11	ND	ND
016S000404	150	5.2	ND
016S000504	15	ND	ND
016S000604	15	ND	ND
016S000704	1500	1100	2.4

Note:

ND = Not detected

Because several of the Appendix IX metals concentrations identified at SWMU 16 were less than background reference concentrations or Risk Based Concentrations (RBCs), and the detected herbicide, pesticide, and SVOC concentrations were less than RBCs, soil removal based on these constituents is unnecessary. For TPH and other petroleum-related constituents, regulatory guidance and action levels are provided by the Tennessee Department of Environment and Conservation (TDEC).

4.4 Regulatory Action Levels

The TDEC Division of Underground Storage Tanks (USTs) recently established uniform soil cleanup standards for petroleum releases that *apply to both regulated and non-regulated UST sites, as well as non-tank-related sites* (Tennessee Senate Bill 2720 [Public Chapter 864], May 3, 1996). These regulations, presented in the TDEC Division of USTs *Environmental Assessment Guidelines* (TDEC, 1996), have established cleanup levels for TPH in soil based on groundwater classification and soil permeability.

Table 7 presents the criteria used to determine the site-specific cleanup standards under these regulations.

Table 7
 TDEC Division of USTs
 TPH Cleanup Levels (mg/kg)

	Soil Permeability		
	$> 10^{-4}$ cm/sec	10^{-4} to 10^{-6} cm/sec	$< 10^{-6}$ cm/sec
Drinking Water	100	250	500
Non-Drinking Water	250	500	1,000

The cleanup levels are based on two variables: soil permeability (vertical) and groundwater classification. Data collected during the nearby SWMU 7 RFI indicate a vertical permeability in the loess of 9.5×10^{-7} cm/sec from the 20 to 22 foot depth. Boring logs at SWMU 7 and SWMU 15 indicate that the lithology of the loess near SWMU 16 is homogeneous, with no known sand stringers or major lithologic variations. In the event that sand stringers or any significant lithology changes in the loess are discovered, the cleanup level will be adjusted accordingly.

Groundwater is classified as a drinking water or a non-drinking water supply based partly on whether it exceeds U.S. Environmental Protection Agency (USEPA) drinking water standards. Based on samples collected from the loess at background wells throughout NSA Memphis, groundwater in this unit exceeds certain national primary and secondary drinking water standards (*Drinking Water Regulations and Health Advisories*, USEPA, 1996), as indicated in Table 8. Exceedances of either Primary or Secondary Standards for loess groundwater probably is the result of relatively large amounts of suspended solids in the samples and analyses of total (non-filtered) water samples.

Table 8
 Background Loess Groundwater Data vs. USEPA Drinking Water Standards
 (µg/L)

Sample ID	Date	Parameter	Result	USEPA Drinking Water Standard	Standard
OBGG01LS01	21-Mar-95	Antimony	20	6	Primary
OBGG01LS02	10-Nov-95	Antimony	25	6	Primary
		Thallium	3	2	Primary
OBGG02LS01	17-Mar-95	Antimony	20	6	Primary
		Chromium	167	100	Primary
		Lead	33.6	15	Primary
		Nickel	143	100	Primary
OBGG02LS02	9-Nov-95	Antimony	25	6	Primary
		Thallium	3	2	Primary
OBGG04LS01	16-Mar-95	Antimony	20	6	Primary
		Chromium	213	100	Primary
		Nickel	165	100	Primary
OBGG04LS02	9-Nov-95	Antimony	25	6	Primary
		Cadmium	5.4	5	Primary
		Chromium	222	100	Primary
		Nickel	157	100	Primary
		Thallium	3	2	Primary
OBGG05LS01	17-Mar-95	Antimony	40.5	6	Primary
		Chromium	160	100	Primary
		Nickel	114	100	Primary
OBGG05LS02	9-Nov-95	Antimony	25	6	Primary
		Thallium	3	2	Primary

Because the vertical permeability of the loess obtained during the SWMU 7 RFI is less than 10^{-6} cm/sec and background wells screened in the loess throughout NSA Memphis have concentrations of several inorganic constituents exceeding drinking water standards, the applicable TDEC cleanup level for TPH in SWMU 16 soil is 1,000 mg/kg.

Based on a site-specific cleanup level of 1,000 mg/kg for TPH, data from Table 6 indicate that only the 1,500 mg/kg TPH concentration in sample 016S000704 exceeds the cleanup level. Therefore, it appears that soil removal is only required around the 3- to 4-foot depth (from the lower-interval sample) at location 016S0007.

5.0 REMOVAL ACTION

The U.S. Army Corps of Engineers will provide the equipment and personnel to remove the ASTs and excavate, stockpile, and dispose of the contaminated soil. EnSafe will assist the Corps as necessary, collect confirmation and soil-disposal samples, and report on the removal activities in a Voluntary Corrective Action report. The following activities will be performed by the designated staff; they are further described in subsequent sections.

- EnSafe will plan field activities, review historical data, and schedule EnSafe personnel and equipment.
- EnSafe will review with the necessary personnel the applicable portions of the Comprehensive RFI Work Plan, the Comprehensive Health and Safety Plan (CHASP) which is included as Appendix C, and the Site-Specific Health and Safety Plan (SSHASP) which is included as Appendix D.

- The Corps will empty, disconnect, remove, and clean the ASTs which will then be taken (by the Corps) to a metal recycler.
- The Corps will designate an area to stockpile contaminated soil and place plastic on the ground surface before stockpiling soil onsite.
- The Corps will excavate and stockpile surface and subsurface soil.
- EnSafe will collect composite soil samples during excavation for field-screening analysis.
- EnSafe will collect one composite disposal profile soil sample from each 100 cubic yards (yd³) of stockpiled soil.
- The Corps will backfill the excavated area with clean soil and reseed it.
- The Corps will cover the stockpile with plastic and maintain this cover until the soil is properly disposed of. The Corps will coordinate disposal of soil and decontamination fluids resulting from field activities.
- The Corps will remove all construction materials.
- EnSafe will prepare a Voluntary Corrective Action report.

5.1 Preremoval Activities

Activities to be conducted before removing the soil are discussed in the following sections.

Orientation Meeting

Before performing any field activities at SWMU 16, EnSafe personnel will hold an orientation meeting to review general and site-specific requirements for sampling and documentation. General discussion will include the locations of the site field office, subject site, and designated decontamination areas. Sampling requirements to be discussed will include general sampling protocol, the sample-numbering system, quality assurance/quality control (QA/QC) sampling requirements, and sample packaging. Documentation requirements to be discussed will include the use of field forms, field logbooks, and photographic documentation.

The EnSafe Site Safety Officer (SSO) will review the CHASP and SSHASP (Appendices C and D, respectively) with EnSafe personnel before any field activities. All EnSafe employees working onsite will be required to sign a form acknowledging that they are familiar with the plan and agree to abide by its guidelines. The SSHASP contains a copy of the compliance agreement form.

5.2 Removal Activities

Several activities will be conducted before and during soil removal. Specific tasks include air monitoring, tank removal, soil excavation, and soil screening. Tank and piping removal procedures are detailed in the *Final Tank Closure Plan* (E/A&H, 1995).

Air Monitoring

If needed, air monitoring will be conducted by the Corps before and in conjunction with any field screening or confirmation sampling. Air monitors to be used include a photoionization detector and a combustible-gas indicator. All air sample readings and locations will be recorded in the

field logbook. Specific air-monitoring procedures are discussed in Section 6.4 of the SSHASP (Appendix D).

Tank Content Removal, Sampling and Disposal. Removal of all liquids and sludges from the tanks will be in accordance with National Fire Protection Association (NFPA) 30, *Flammable and Combustible Liquids*. In the event of a fire or explosion hazard resulting from an underground release of flammable or combustible liquid, the procedures outlined in NFPA 329, *Recommended Practice for Handling Underground Releases of Flammable and Combustible Liquids*, will be followed. All usable product will be stored in appropriate containers for later delivery to or pickup by Defense Reutilization and Marketing Office (DRMO) Memphis. For waste tanks, liquids will be pumped into a tank truck for disposal at an appropriate facility. One sample will be collected from each tank for waste characterization to facilitate waste disposal. A summary of the analytical requirements and proposed number of samples is provided in Section 5.4.

Tank and Piping Removal and Disposal. This element includes decontamination, demolition, and disposal of the tanks. Before closing the tanks, the supply and fill lines, and any other piping leading to or from the tanks will be drained, disconnected and capped. If asbestos lines are encountered during the removal, the Corps will notify the NSA Memphis Public Works Division who will provide arrangements for the removal and off-site disposal of the asbestos. Access equipment such as ladders and guard rails will be removed before tank removal. Water from triple-rinsing of the tanks will be contained and discharged to an oil-water separator. The concrete tank supports will be crushed, removed, and placed in a temporary stockpile for later reuse. These ASTs are not regulated under the *Tennessee Underground Storage Tank Act* and therefore have no associated UST regulations. The tanks will be turned in to a metal recycler by the Corps.

Surface and Subsurface Soil Excavation

Soil excavation will start with removal of 3 feet of overburden within a 10-foot radius of location 016S0007. The overburden will be stockpiled near the excavation for use as backfill. Removal of 1-foot thick, 20-foot diameter lifts will continue until field screening indicates that soil remaining on the sides and bottom of the excavation contains concentrations of TPH that are less than the action level of 1,000 mg/kg. The amount of overburden soil to be removed is estimated at 35 yds³. Assuming that only one 1-foot lift of contaminated soil from 3 to 4 feet deep is removed, then an additional 11.6 yds³ of contaminated soil will be generated. Stained soil visible in the grassy areas south and east of the tanks and the stained gravels west of the tanks will be removed in a similar manner (though 1-foot lifts) until field screening indicates that the remaining soil contains concentrations of TPH that are less than the 1,000 mg/kg action level.

The Corps is expected to excavate with a large backhoe or trackhoe. As the soil is excavated, it will be segregated and stockpiled onsite into an overburden pile and a potentially contaminated soil pile. Both piles will be sampled by EnSafe for confirmation and disposal characterization. The stockpiled soil will be placed on plastic and covered with plastic to prevent cross-contamination and erosion. The Corps will be responsible for maintaining the plastic cover on the stockpiled soil. A five-day turnaround time will be requested for the disposal profile samples, which will be analyzed for toxicity characteristic leaching procedure (TCLP)-metals and TCLP-benzene.

Overburden samples will be collected to determine whether the overburden material may be used as fill material. Two 5-part composites will be collected from the overburden and will be analyzed on-site for TPH (described below). Upon collection of this data and within five days receipt of the analytical data from the laboratory, EnSafe will attach a summary of detections to the data package and forward two copies to the Navy. If the overburden contains greater than 100 ppm TPH it will not be used as backfill and it will be profiled for waste disposal (TCLP-metals and

TCLP-benzene). Contaminated soil will be properly disposed of in accordance with current USEPA and TDEC regulations. Any special waste soil will be disposed of by the Corps, while any hazardous waste soil will be disposed of by the Navy.

Soil Screening

Using disposable spoons or decontaminated stainless-steel spoons and bowls, EnSafe personnel will collect soil samples from the excavation walls and base as each 20-foot diameter lift is removed. These samples will be collected from the backhoe bucket, if necessary. Soil samples will be collected from the center of the bucket to avoid sample contamination from the bucket wall. Personnel will not enter the excavation if it is greater than 4 feet deep. The samples will be collected in accordance with the procedures described in Section 4.4.3 of the Comprehensive RFI Work Plan.

Samples will be screened using an infrared (IR) TPH Plus Field Analyzer, which performs analyses based on USEPA Method 418.1 (IR method). The excavation will continue until field screening demonstrates that the contaminated soil has been removed to concentrations less than the site-specific remediation level of 1,000 mg/kg.

5.3 Postremoval Activities

Several activities will be conducted after soil is removed, including confirmation soil sampling, backfilling the excavation, and disposing of used personal protective equipment (PPE) and disposable sampling equipment.

Confirmation Soil Sampling

When field screening demonstrates that the contaminated soil has been removed to less than the site-specific remediation level of 1,000 mg/kg TPH, EnSafe will collect a 5-part composite sample from each of the excavation walls and four grab samples from the excavation floor (one from each corner). Three grab samples will also be collected from beneath the stained areas on the east, west, and south sides of the tanks for a total of 11 confirmation samples. The number of samples may be adjusted according to the size of the excavation. These confirmation soil samples will be analyzed onsite using the TPH Plus Field Analyzer for TPH (Method 418.1) and at an offsite laboratory for Appendix IX metals (USEPA Method 6010/7000 series).

Any water encountered in the excavation will be containerized in properly labeled U.S. Department of Transportation (DOT)-approved 55-gallon drums by the Corps. EnSafe will collect samples of the water for analyses of VOCs, and oil and grease. The drums will remain onsite. Upon approval from the City of Millington publicly owned treatment works, the water will be discharged via an oil-water separator to the sewer by the Corps. If any water is not approved for discharge to the sewer, then the Navy will arrange for proper disposal of the water. EnSafe will be responsible for collecting any water samples required by the disposal facility and obtaining any additional analyses to determine the appropriate means for disposal of water.

Backfill of the Excavation

The excavation will remain open until confirmation samples document that soil exceeding the TPH action level of 1,000 mg/kg has been removed and the BCT has approved backfilling based on a review of the TPH and metals concentrations. A temporary fence or barricade will be placed around the excavation. Any clean overburden from the excavation will be combined with soil from an offsite source and will be used by the Corps for backfill. The area will then be seeded by the Corps.

Removal of Construction Materials

After stockpiled soil has been removed or backfilled, any debris or trash associated with field activities will be removed by the Corps. The area will be left as close as possible to its natural state.

Disposal of PPE and Disposable Sampling Equipment

Used PPE and disposable sampling equipment such as plastic sheeting will be profiled for disposal, along with the excavated soil. Any used PPE or disposable sampling equipment will be stockpiled, along with the excavated soil for loading and disposal, after the disposal profile is approved. Corps personnel will be responsible for the proper disposal of all PPE and disposable equipment. Section 5.9, Investigation-Derived Waste, has additional information on waste disposal.

The Voluntary Corrective Action Report

EnSafe will prepare a report after field activities are complete and analytical results have been received to address the following:

- Field activities, including a description of the field screening and sampling activities.
- Analytical test results for confirmation samples collected following the soil removal.
- A diagram showing the features of the site during the removal action. The diagram will include the location of the excavation, soil sample locations, and detected concentrations.
- Disposal manifests (if available at the time of report) and a description of the fate of water generated during the removal action, if any.

EnSafe will submit a report describing its activities during the soil removal.

5.4 Analytical Requirements

Analytical requirements for the samples scheduled to be collected at SWMU 16 are summarized in Table 9. Confirmation samples will be analyzed for TPH (in the field using USEPA Method 418.1) and Appendix IX metals (USEPA Method 6010/7000 series). One characterization sample for soil disposal, which will be collected using a decontaminated stainless-steel hand auger or spoon and bowl for every 100 yd³ of soil, will be analyzed for toxicity characteristic leaching procedure (TCLP) metals, and TCLP benzene. EnSafe will collect any additional samples required by the disposal facility and submit them for the required analyses, if needed. Overburden samples will be analyzed for TPH as needed.

Table 9
Sample Summary and Analytical Requirements

Sample Type	Matrix	Analytical Parameters	Turnaround Time	# of Samples	Laboratory
Extent Verification	Soil	TPH (Method 418.1)	Field Analysis	TBD ^a	N/A ^b
Confirmation	Soil	TPH (Method 418.1) Appendix IX Metals (Method 6010/7000)	Field Analysis 5 days	11 ^c	N/A, ETC ^d
Overburden	Soil	TPH (Method 418.1)	Field Analysis	2 ^e	N/A
Soil Disposal	Soil (Excavated Material)	TCLP RCRA Metals (Method 6010/7000) TCLP Benzene (Method 8260)	5 days	1 ^f	ETC
Tank 369 Waste Characterization	Sludge/Liquid	Flashpoint (Method 1010) TCLP RCRA Metals (Method 6010/7000) TCLP VOCs (Method 8260) TCLP Pesticides/PCBs (Method 8081/8082)	5 days	1	ETC

Table 9
Sample Summary and Analytical Requirements

Sample Type	Matrix	Analytical Parameters	Turnaround Time	# of Samples	Laboratory
Extent Verification	Soil	TPH (Method 418.1)	Field Analysis	TBD ^a	N/A ^b
Tank 370 Waste Characterization	Sludge/Liquid	Flashpoint (Method 1010) TCLP Lead (Method 6010/7421) TCLP Benzene (Method 8260)	5 days	1	ETC

Notes:

- a — To be determined in the field.
- b — Not applicable. Samples to be analyzed in the field.
- c — Includes four grab samples from the four corners of the proposed excavation, four composite samples from the walls of the excavation, and three grab samples from beneath the stained areas.
- d — Environmental Testing & Consulting, Memphis, Tennessee
- e — Two five-part composites
- f — Assuming overburden material is not contaminated with TPH. Otherwise, two samples will be collected for disposal characterization.

Field measurements at SWMU 16 will be conducted in accordance with Section 4.10.1 of the Comprehensive RFI Work Plan. IR method screening of soil samples will be performed in accordance with the manufacturer's instructions.

5.5 Sample Management

Samples will be managed in accordance with Sections 4.12 and 5 of the Comprehensive RFI Work Plan.

5.6 Sample Custody

Sample custody will be maintained in accordance with Section 4.12.5 of the Comprehensive RFI Work Plan.

5.7 Quality Assurance/Quality Control

QA/QC procedures to be followed during sampling activities will be in accordance with Section 4.14.2 of the Comprehensive RFI Work Plan.

5.8 Decontamination Procedures

Decontamination will be performed in accordance with Section 4.11 of the Comprehensive RFI Work Plan.

5.9 Investigation-Derived Waste

Investigation-derived waste (IDW) will be handled in accordance with Section 4.13 of the Comprehensive RFI Work Plan and the *Investigation-Derived Waste Management Plan* (EnSafe, 1995). The Corps and/or the NSA Memphis Public Works Office will properly dispose of all IDW.

6.0 QUALITY ASSURANCE PLAN

The quality assurance procedures presented in Section 4.14 of the Comprehensive RFI Work Plan will be followed for sampling activities at SWMU 16.

7.0 DATA MANAGEMENT PLAN

The data management procedures presented in Section 5 of the Comprehensive RFI Work Plan will be followed for sampling activities at SWMU 16.

8.0 HEALTH AND SAFETY PLAN

Since EnSafe does not have responsibility for the soil removal, the Corps shall provide a written health and safety plan for removal activities for its employees which shall meet, at a minimum, the requirements specified in the EnSafe CHASP and include all site-specific information

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concerning types of activities, site contaminants, etc. The Corps's health and safety plan will be submitted to TDEC for review prior to its implementation. During confirmation sampling, EnSafe personnel will comply with the CHASP (Appendix C) and the SSHASP (Appendix D).

9.0 REFERENCES

- Bouwer, H., and R.C. Rice (1976). *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*. Water Resources Research. 12(3):423-328.
- Carmichael, J.K., Parks, W.S., Kingsbury, J.A. and Ladd, D.E. (1997). *Hydrogeology and Groundwater Quality at the Naval Support Activity Memphis, Millington, Tennessee*. U.S. Department of the Interior, U.S. Geological Survey, Water-Resources Investigation Report 97-4011.
- EnSafe/Allen & Hoshall (1997). *Assembly D Site Investigation Plan, — SWMU 16, N-94 Aboveground Waste Storage Tanks*, Revision 2. E/A&H: Memphis, Tennessee.
- EnSafe/Allen & Hoshall (1994). *Comprehensive RFI Work Plan for Naval Air Station Memphis*. E/A&H: Memphis, Tennessee.
- EnSafe/Allen & Hoshall (1995). *Final Tank Closure Plan for Naval Air Station Memphis*. E/A&H: Memphis, Tennessee.
- EnSafe/Allen & Hoshall (1995). *Naval Support Activity Memphis IDW Management Plan*. E/A&H: Memphis, Tennessee.
- EnSafe/Allen & Hoshall (1997). *Technical Memorandum Reference Concentrations*. E/A&H: Memphis, Tennessee.

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ERC/EDGE (1990a). *Visual Site Inspection Report, NAS Memphis, Millington, TN.* ERC/EDGE:
Nashville, Tennessee.

ERC/EDGE (1990b). *RCRA Facility Assessment, NAS Memphis.* ERC/EDGE:
Nashville, Tennessee.

Tennessee Senate Bill 2720 (May 3, 1996). Public Chapter 864.

Tennessee Department of Environment and Conservation (1996). *Environmental Assessment Guidelines.* TDEC Division of UST, Nashville, Tennessee.

U.S. Environmental Protection Agency (1996). *Drinking Water Regulations and Health Advisories.* USEPA, Office of Water.

U.S. Environmental Protection Agency (1989). *Risk Assessment Guidance for Superfund: Vol. 1 — Human Health Evaluation Manual (Part A).* OSWER Directive 9285.7-01.

U.S. Environmental Protection Agency (1997). *Risk-Based Concentration Table.* U.S. EPA Region III Office of RCRA. Philadelphia, Pennsylvania.

Appendix A
Boring Logs

EnSafe/Allen & Hoshall

Monitoring Well 015G01UF

Project: NSA Memphis

Location: *Millington, TN* *SMU #15*

Project No: 0094-08420

Surface Elevation: 279.63 feet msl

Started at 0755 on 3-14-96

TOC Elevation: 282.06 feet msl

Completed at 0935 on 3-14-96

Depth to Groundwater: 26.13 feet

Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing.

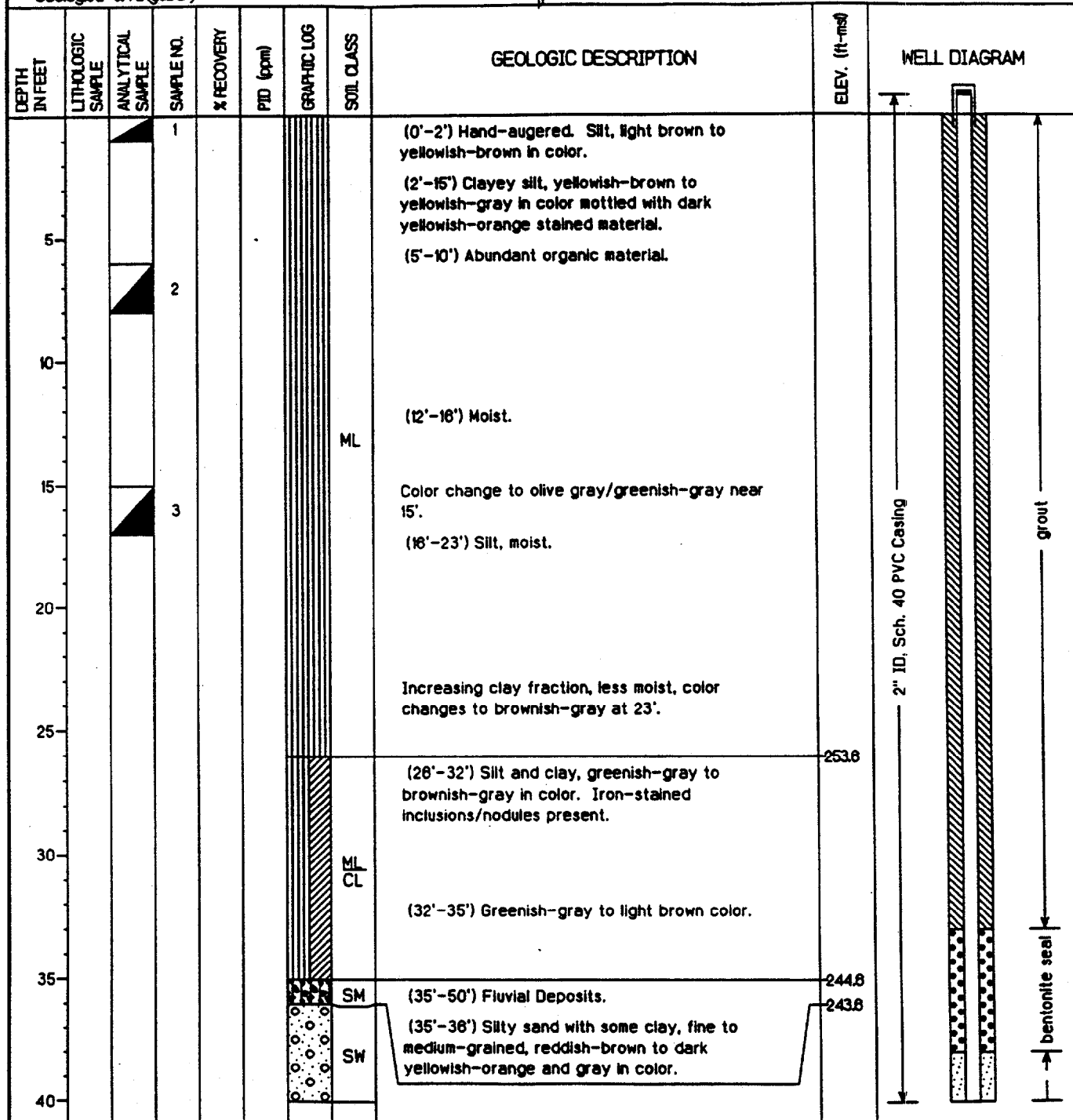
Groundwater Elevation: 255.93 feet msl

Drilling Company: Alliance Environmental, Inc.


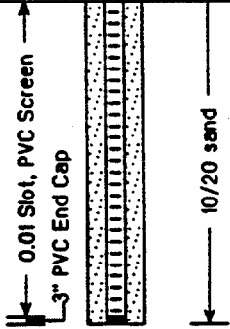
Total Depth: 50.25 feet

Geologist: J. Kingsbury

Well Screen: 40 to 50 feet



<i>EnSafe/Allen & Hoshall</i>										Monitoring Well 015G01UF	
Project: NSA Memphis										Location: <i>Millington, TN</i> <i>SNMU #15</i>	
Project No.: 0094-08420										Surface Elevation: 279.63 feet msl	
Started at 0755 on 3-14-96										TOC Elevation: 282.06 feet msl	
Completed at 0935 on 3-14-96										Depth to Groundwater: 28.13 feet Measured: 4/8/96	
Drilling Method: <i>Rotasonic - 4" core barrel inside 6" casing.</i>										Groundwater Elevation: 255.93 feet msl	
Drilling Company: <i>Alliance Environmental, Inc.</i>										Total Depth: 50.25 feet	
Geologist: <i>J. Kingsbury</i>										Well Screen: 40 to 50 feet	

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM
45							SW	(38'-38') Sand, fine to medium-grained, light brown to dark yellowish- orange color mottled with light gray-colored material. Color changes to dark yellowish-orange from 43' to 46'. (46'-50') Sand, medium to coarse-grained, with a trace of pea-size gravel, dark yellowish-orange to pinkish-gray.		
50								Terminated soil boring at 50'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 015G01LF.	229.6	
55										
60										
65										
70										
75										
80										

EnSafe/Allen & Hoshall

Monitoring Well 015G01LF

Project: NSA Memphis

Location: Millington, TN SHMU #15

Project No: 0094-08420

Surface Elevation: 279.47 feet msl

Started at 1225 on 3-13-96

TOC Elevation: 281.90 feet msl

Completed at 1545 on 3-13-96

Depth to Groundwater: 26.55 feet Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing.

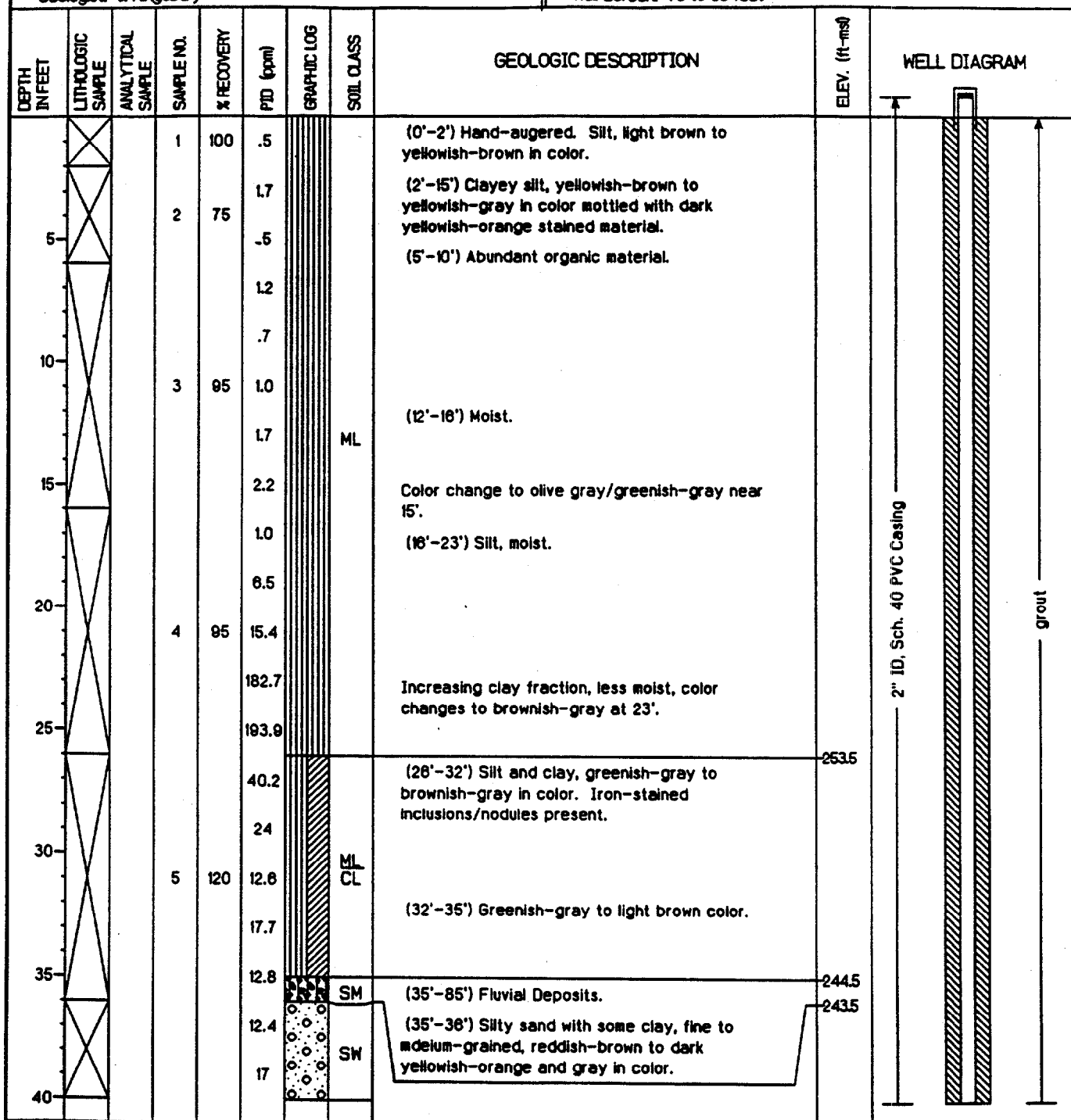
Groundwater Elevation: 255.35 feet msl

Drilling Company: Alliance Environmental, Inc.

Total Depth: 96 feet

Geologist: J. Kingsbury

Well Screen: 75 to 85 feet



EnSafe/Allen & Hoshall

Monitoring Well 015G01LF

Project: NSA Memphis	Location: <i>Milington, TN</i> <i>SNMU #15</i>
Project No: 0094-08420	Surface Elevation: 279.47 feet msl
Started at 1225 on 3-13-96	TOC Elevation: 281.90 feet msl
Completed at 1545 on 3-13-96	Depth to Groundwater: 26.55 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 255.35 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 96 feet
Geologist: J. Kingsbury	Well Screen: 75 to 85 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (gpm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
45			6	110	18.4			(36'-38') Sand, fine to medium-grained, light brown to dark yellowish- orange color mottled with light gray-colored material. Color changes to dark yellowish-orange from 43' to 46'.		
					37.1					
					59.4					
					48.3			(46'-53') Sand, medium to coarse-grained, with a trace of pea-size gravel dark yellowish-orange to pinkish-gray.		
50			7	100	29.3		SW			
					8.6			Color changes to very light gray/very light olive gray.		
					1.2					
55					1.0			Sand is fine to medium-grained and micaceous, very light gray to pinkish-gray.		
					1.0					
					0.5					
60			8	110	0.5		SW	(60'-62') Sand (fine to very coarse-grained) and gravel (up to 1" in longest dimension). Dusky yellow to yellowish-gray in color.	219.5	
					0.5		SW	(62'-64') Sand lense present.	217.5	
					0.5		SW	(64'-69') Sand, fine to very coarse-grained, and gravel (up to 1" in longest dimension). Becomes more dark yellowish-orange to dusky yellow color from 66' to 69'.	215.5	
65					0.5		GW		212.5	
					0.5			(67'-68') Gravel lens.	211.5	
70			9	105	0.5			(68'-85') Sand, medium to very coarse-grained, and gravel, dusky yellow to yellowish-gray.		
					0.5			(70'-76') Gravel fraction decreasing.		
					0.5		SW			
75					0.5					
					0.5					
80					0.5			(78'-85') Gravel fraction increasing, color changes to reddish- brown and dark yellowish-orange.		

EnSafe/Allen & Hoshall

Monitoring Well 015G01LF

Project: NSA Memphis	Location: Millington, TN SHMU #15
Project No: 0094-08420	Surface Elevation: 279.47 feet msl
Started at 1225 on 3-13-96	TOC Elevation: 281.90 feet msl
Completed at 1545 on 3-13-96	Depth to Groundwater: 26.55 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 255.35 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 96 feet
Geologist: J. Kingsbury	Well Screen: 75 to 85 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85			10	100	0.5		SGW		84.5	
					0.5					
					0.5					
90			11	80	0.5		SP	(85'-96') Cockfield Formation: Sand, fine-grained, very light gray in color. Some clay streaks and yellowish-gray to light olive gray in color.		
					0.5					
95					0.5				83.5	
								Terminated soil boring at 96'.		
100										
105										
110										
115										
120										

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G02UF

Project: NSA Memphis	Location: Millington, TN. SHMUM#5
Project No.: 0094-08420	Surface Elevation: 283.20 feet msl
Started at: 0800 on 3-11-86	TOC Elevation: 283.00 feet msl
Completed at: 1000 on 3-11-86	Depth to Groundwater: 25.87 feet Measured: 4/8/86
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 257.13 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 48.25 feet
Geologist: D. Ladd, W. Parks	Well Screen: 36 to 46 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ft)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM
			1				SW SC	(0'-5') Concrete. (.5'-2') Hand-augered. Sand, gravel, and clay fill from .5' to 3.5'.		
5							ML	(3.5'-6') Clayey silt, olive gray to moderate yellowish-brown in color. Mostly olive gray-colored near 3.5', locally stained dark yellowish-orange with some organic material.	279.7	
			2					(6'-18') Silt, moderate yellowish-brown mottled with light olive-gray material.	277.2	
10							ML	Moist below 11'.		
15			3					(16'-18') Very moist.		
20							ML	(18'-25') Clayey silt, dark yellowish-brown in color. Becoming dark yellowish-brown to moderate yellowish-brown near 25'.	265.2	
25							ML	(25'-30') Silt. Dark yellowish-brown with dark yellowish-orange staining from 25' to 26', becoming moderate yellowish-brown mottled with light olive gray and dark yellowish-orange material between 26' and 30'.	258.2	
30							ML CL		253.2	

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G02UF

Project: NSA Memphis	Location: <i>Millington, TN</i> <i>SNMUF5</i>
Project No: 0084-08420	Surface Elevation: 283.20 feet msl
Started at 0800 on 3-11-86	TOC Elevation: 283.00 feet msl
Completed at 1000 on 3-11-86	Depth to Groundwater: 25.87 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 257.13 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 48.25 feet
Geologist: D. Ladd, W. Parks	Well Screen: 36 to 48 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
							CL	(30'-33') Silt and clay, moderate yellowish-brown color mottled with sparse light olive-gray material. Progressively sandier near 33'.	283.20	<p>2" ID, Sch. 40 PVC Casing</p> <p>3" PVC End Cap</p> <p>10/20 sand</p> <p>bentonite seal</p>
							SP	(33'-46') Fluvial Deposits.	250.2	
35							SC	(33'-35') Silty and clayey sand, very fine to fine-grained, moderate yellowish-brown color mottled with sparse light olive gray material, contains iron-manganese nodules. Silt and clay decrease near 35'.	248.2	
							SP	(35'-36') Clayey sand, very fine to fine-grained, light brown to moderate reddish-brown color mottled with light olive gray material, contains iron concretions.	247.2	
40			4				SP	(36'-38') Sand, fine-grained, light brown to moderate reddish-brown color mottled with yellowish-gray material, wet.	244.2	
							SP	Sand, fine-grained olive gray mottled with sparse yellowish-gray material.	240.2	
45			5				SP	(40'-42') Collected a Shelby tube sample.	237.2	
								(43'-48') Sand, fine-grained, yellowish-gray in color, wet.		
								Terminated soil boring at 48'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 015G02LF.		
50										
55										
60										



Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 03/25/96

Project No.: E-3-157

Client's Project No.: 010609000

Sample I.D.: 015S02UF42

Soil Description: Brown Sand

Test Media: City of Memphis Water

	<u>Pre-Test</u>	<u>Post Test</u>
Wet Density (Lbs/ft ³)	129.0	131.4
Dry Density (Lbs/ft ³)	106.5	111.6
Moisture (% Dry Wt)	21.1	18.2
Porosity (n)	.349	.314
Degree of Saturation (%)	1.00	1.00
Specific Gravity (ASTM D-854)	2.61	---

Permeability

Temperature Correction, $R_t = 1.043$

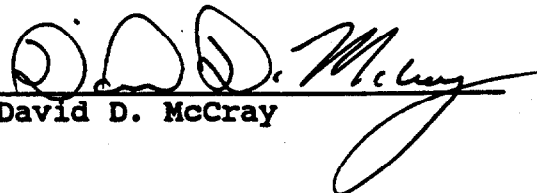
$$\begin{aligned}K_1 &= 1.8 \times 10^{-4} \text{ cm/sec} \\K_2 &= 1.6 \times 10^{-4} \text{ cm/sec} \\K_3 &= 1.1 \times 10^{-4} \text{ cm/sec} \\K_4 &= 1.7 \times 10^{-4} \text{ cm/sec}\end{aligned}$$

Coefficient of Permeability, $K_{20} = 1.7 \times 10^{-4} \text{ cm/sec}$

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-019

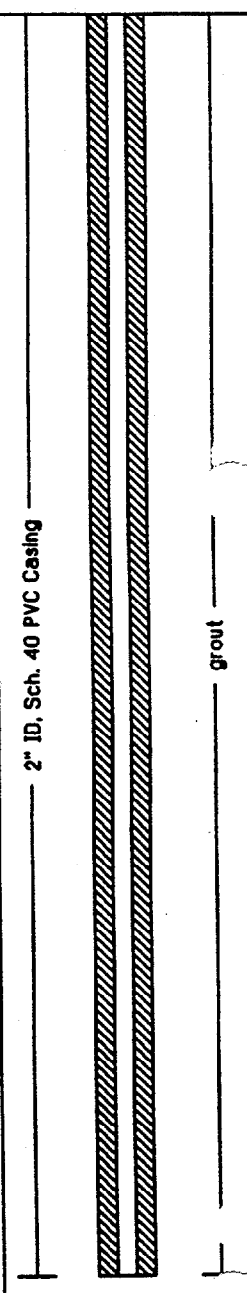
Reviewed By:


David D. McCray

[illegible]

EnSafe/Allen & Hoshall							Monitoring Well 015G02LF			
Project: NSA Memphis							Location: Millington, TN SHMUM15			
Project No.: 0094-08420							Surface Elevation: 283.36 feet msl			
Started at 0819 on 3-6-96							TOC Elevation: 282.85 feet msl			
Completed at 1011 on 3-6-96							Depth to Groundwater: 26.46 feet Measured: 4/8/96			
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.							Groundwater Elevation: 256.39 feet msl			
Drilling Company: Alliance Environmental, Inc.							Total Depth: 96 feet			
Geologist: D. Ladd, W. Parks							Well Screen: 75 to 85 feet			






DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (bpm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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EnSafe/Allen & Hoshall										Monitoring Well 015G02LF	
Project: NSA Memphis										Location: Millington, TN SHM#5	
Project No: 0094-08420										Surface Elevation: 283.36 feet msl	
Started at 0819 on 3-6-96										TOC Elevation: 282.85 feet msl	
Completed at 1011 on 3-6-96										Depth to Groundwater: 26.46 feet Measured: 4/8/96	
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.										Groundwater Elevation: 256.39 feet msl	
Drilling Company: Alliance Environmental, Inc.										Total Depth: 96 feet	
Geologist: D. Ladd, M. Parks										Well Screen: 75 to 85 feet	
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ft)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM	
			6	130	112		CL	(30'-33') Silt and clay, moderate yellowish-brown color mottled with sparse light olive-gray material. Progressively sandier near 33'.	253.4		
					131		SC SM	(33'-86.5') Fluvial Deposits.	250.4		
35					17		SC	(33'-35') Silty and clayey sand, very fine to fine-grained, moderate yellowish-brown color mottled with sparse light olive gray material, contains iron-manganese nodules. Silt and clay content decrease near 35'.	248.4		
					13		SP		247.4		
					10		SP	(35'-38') Clayey sand, very fine to fine-grained, light brown to moderate reddish-brown color mottled with light olive gray material, contains iron concretions.	244.4		
40			7	100	2.2		SP	(38'-39') Sand, fine-grained, light brown to moderate reddish-brown color mottled with yellowish-gray material, wet.			
					BG			(39'-43') Sand, fine-grained olive gray mottled with sparse yellowish-gray material.	240.4		
45					BG		SP	(43'-46') Sand, fine-grained, yellowish-gray in color, wet.			
					BG			(46'-52') Sand, fine-grained with rare clay seams, light brown mottled with grayish-orange material, wet.	237.4		
50			8	100	BG		SP				
					BG			(52'-63') Sand, fine-grained, grayish-orange in color, wet.	231.4		
55					BG			Rare piece of gravel at 54', and a light gray clay seam at 55'.			
					BG		SP				
60					BG						

EnSafe/Allen & Hoshall							Monitoring Well 015G02LF			
Project: NSA Memphis							Location: Millington, TN SHM/JF5			
Project No: 0094-08420							Surface Elevation: 283.36 feet msl			
Started at 0819 on 3-6-86							TOC Elevation: 282.85 feet msl			
Completed at 1011 on 3-6-86							Depth to Groundwater: 26.46 feet Measured: 4/8/86			
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.							Groundwater Elevation: 256.39 feet msl			
Drilling Company: Alliance Environmental, Inc.							Total Depth: 86 feet			
Geologist: D. Ladd, W. Parks							Well Screen: 75 to 85 feet			

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
			9	80	BG		SP			<p>2" ID, Sch. 40 PVC Casing</p> <p>0.01 Slot, PVC Screen</p> <p>3" PVC End Cap</p> <p>grout</p> <p>bentonite seal</p> <p>10/20 sand</p> <p>bentonite plug</p>
65					BG			(63'-75.5') Sand and gravel (see descriptions below).	220.4	
					BG			(63'-66') Sand (fine to very coarse-grained) and gravel (up to 1" in longest dimension). Grayish-orange to dark yellowish-orange in color. Wet. Gravel is mostly composed of quartz and chert. Gravel is scattered near 63'.		
					BG			(66'-75.5') Sand, medium to very coarse-grained, and gravel (up to 1.5" in longest dimension). Gravel is angular to rounded quartz and chert. Dark yellowish-orange to grayish-orange in color. Wet.		
70			10	80	BG		SM GW	3" thick, fine-grained sand lense at 75', very little gravel content, and grayish-orange in color.		
					BG					
75					BG					
					BG		SP	(75.5'-76') Sand, fine-grained, grayish-orange, wet.	207.9 207.4	
					BG			(76'-86.5') Sand (coarse to very coarse-grained) and gravel (up to 2" in longest dimension). Dark yellowish-orange to moderate yellowish- brown, mottled with finer-grained grayish-orange sand near 79', 80', 84', and 86'. Wet.		
80			11	90	BG		SM GW			
					BG					
85					BG			(86'-86.5') Becoming clayey.		
					BG		SC	(86.5'-87') Cockfield Formation: Very clayey sand, fine-grained, yellowish-gray mottled with very light gray and dark yellowish-orange material.	186.9 186.4	
90					BG		SM SC			

EnSafe/Allen & Hoshall								Monitoring Well 015G02LF		
Project: <i>NSA Memphis</i>								Location: <i>Millington, TN</i> <i>SHMU#5</i>		
Project No.: <i>0094-08420</i>								Surface Elevation: <i>283.36 feet msl</i>		
Started at <i>0819 on 3-6-96</i>								TOC Elevation: <i>282.85 feet msl</i>		
Completed at <i>1011 on 3-6-96</i>								Depth to Groundwater: <i>26.46 feet</i> Measured: <i>4/8/96</i>		
Drilling Method: <i>Rotasonic - 4" core barrel inside 6" casing.</i>								Groundwater Elevation: <i>256.39 feet msl</i>		
Drilling Company: <i>Alliance Environmental, Inc.</i>								Total Depth: <i>96 feet</i>		
Geologist: <i>D. Ladd, H. Parks</i>								Well Screen: <i>75 to 85 feet</i>		

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft- <i>msl</i>)	WELL DIAGRAM
95			12	100			SM SC	(87'-93') Silty sand, fine-grained, with some light gray clay seams, yellowish-gray in color mottled with dark yellowish-orange material, very wet.	90.4	 <div style="position: absolute; left: 940px; top: 300px; font-size: small;">bentonite plug</div>
							SP	(93'-96') Fine-grained sand with a few thin clay seams, yellowish-gray mottled with sparse dark yellowish-orange material, wet.	87.4	
								Terminated soil boring at 96'.		
100										
105										
110										
115										
120										

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G03UF

Project: NSA Memphis	Location: Millington, TN SHMU #15
Project No: 0094-08420	Surface Elevation: 280.10 feet msl
Started at 0950 on 3-12-96	TOC Elevation: 282.36 feet msl
Completed at 1230 on 3-12-96	Depth to Groundwater: 25.35 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 257.01 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 55 feet
Geologist: J. Kingsbury	Well Screen: 44 to 54 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
			1				SW GW	(0'-2') Sand and gravel (fill).		
5							ML	(2'-6") Silt, reddish-brown to olive gray in color, with some gravel (fill).	278.1	
			2					(6'-16") Clayey silt, olive gray to yellowish-brown, organic material present.	274.1	
10							ML			
15			3					(16'-24") Silt, yellowish-brown to yellowish-gray in color and mottled dark yellowish-orange-colored material. Moist.	264.1	
20							ML			
25								(24'-26") Olive gray to greenish-gray.		
							ML	(26'-36") Clayey silt (see descriptions below). (26'-32") Greenish-gray to olive gray in color, organic material with iron staining present from 26' to 32'.	254.1	
30										

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G03UF

Project: NSA Memphis

Location: Millington, TN SHMU #15

Project No.: 0094-08420

Surface Elevation: 280.10 feet msl

Started at 0950 on 3-12-96

TOC Elevation: 282.36 feet msl

Completed at 1230 on 3-12-96

Depth to Groundwater: 25.35 feet Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing


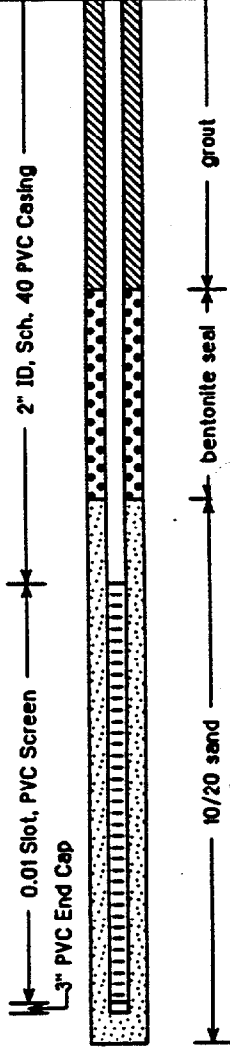



Groundwater Elevation: 257.01 feet msl

Drilling Company: Alliance Environmental, Inc.

Total Depth: 55 feet

Geologist: J. Kingsbury

Well Screen: 44 to 54 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM
35							ML	(32'-36') Mottled light olive gray and light brown in color.		 <p>2" ID, Sch. 40 PVC Casing</p> <p>0.01 Slot, PVC Screen</p> <p>3" PVC End Cap</p> <p>bentonite seal</p> <p>10/20 sand</p> <p>grout</p>
40							ML	Clay, silt, and fine-grained sand with a trace amount of gravel. Mottled reddish-brown to yellowish-brown/light olive gray in color, moist to wet. Fluvial deposits contact estimated at 42' based on geophysical log interpretation.	244.1	
45							SC	Clayey sand, fine to medium-grained, mottled olive gray to reddish-brown in color, dense, with some iron concretions near 50'.	234.1	
50							SW	Sand, fine to coarse-grained, yellowish-brown to yellowish-gray in color.	228.1	
55								Terminated soil boring at 55'. Note: No samples were collected for lithologic description. Descriptions were transferred from the log of adjacent monitoring well 015G03LF.	225.1	
60										

EnSafe/Allen & Hoshall								Log of Monitoring Well 015G03LF		
Project: NSA Memphis								Location: Millington, TN SHMU #15		
Project No.: 0094-08420								Surface Elevation: 280.29 feet msl		
Started at 1215 on 3-11-86								TOC Elevation: 282.55 feet msl		
Completed at 1800 on 3-11-86								Depth to Groundwater: 28.60 feet Measured: 4/8/86		
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.								Groundwater Elevation: 256.35 feet msl		
Drilling Company: Alliance Environmental, Inc.								Total Depth: 86 feet		
Geologist: J. Kingsbury								Well Screen: 78 to 88 feet		
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ftm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
			1	83	4.2		SW GW	(0'-2') Sand and gravel (fill).		
5					3.1		ML	(2'-8') Silt, reddish-brown to olive gray in color, with some gravel (fill).	278.3	
					2					
					1.5			(8'-16') Clayey silt, olive gray to yellowish-brown, organic material present.	274.3	
10			2	50	1.1					
					1.3		ML			
					0.6					
15					0.4					
					0.0			(16'-24') Silt, yellowish-brown to yellowish-gray in color and mottled with dark yellowish-orange-colored material. Moist.	264.3	
					0.4					
20			3	100	0.4		ML			
					0.4					
					0.4			(24'-26') Color changes to olive gray to greenish-gray.		
25					0.4					
					0.4		ML	(26'-36') Clayey silt (see descriptions below). (26'-32') Greenish-gray to olive gray in color, organic material with iron staining present.	254.3	
					0.4					
30										

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G03LF

Project: NSA Memphis

Location: Millington, TN SHMU #15

Project No.: 0094-08420

Surface Elevation: 280.29 feet msl

Started at 1215 on 3-11-96

TOC Elevation: 282.55 feet msl

Completed at 1600 on 3-11-96

Depth to Groundwater: 26.60 feet Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing

Groundwater Elevation: 258.35 feet msl

Drilling Company: Alliance Environmental, Inc.

Total Depth: 96 feet

Geologist: J. Kingsbury

Well Screen: 78 to 88 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ft)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM
35			4	80	0.4		ML	(32'-36") Mottled light olive gray and light brown in color.		
					0.4					
					0.4					
40			5	110	0.4		ML	Clay, silt, and fine-grained sand, with a trace amount of gravel. Mottled reddish-brown to yellowish-brown/light olive gray in color, moist to wet. Fluvial deposits contact estimated at 42' based on geophysical log interpretation.	244.3	
					0.4					
					0.4					
45					0.4					
					0.4					
					0.4					
50			6	110	0.4		SC	Clayey sand, fine to medium-grained, mottled olive gray to reddish-brown in color, dense, with some iron concretions near 50'.	234.3	
					0.4					
					0.4					
55					0.4		SW	Sand, fine to coarse-grained, yellowish-brown to yellowish-gray in color. With gravel from 55' to 56'. Coarsening from 51'-56'.	229.3	
					0.4					
					0.4					
					0.4		SW	Sand and gravel, yellowish-gray in color.	224.3	
					0.4		GW			
					0.4		ML	Silt and clay, yellowish-brown in color.	222.3	
					0.4		CL			
60					0.4		SW	Sand, medium to coarse-grained, reddish-brown in color.	221.3	

2" ID, Sch. 40 PVC Casing

grout

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G03LF

Project: NSA Memphis

Location: Millington, TN SHMU #15

Project No.: 0094-08420

Surface Elevation: 280.29 feet msl

Started at 1215 on 3-11-96

TOC Elevation: 282.55 feet msl

Completed at 1600 on 3-11-96

Depth to Groundwater: 26.60 feet Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing

Groundwater Elevation: 256.35 feet msl

Drilling Company: Alliance Environmental, Inc.

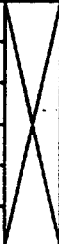




Total Depth: 86 feet

Geologist: J. Kingsbury

Well Screen: 78 to 86 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85			7	110	0.4		SW		27.3	
					0.4			Sand and gravel; sand is medium to coarse-grained, reddish-brown.		
					0.4			(86'-87') Reddish-brown to dark yellowish-orange in color.		
70			8	100	0.4		SW			
					0.4		GW			
75					0.4					
					1.0					
80			9	100	1.1				88.3	
					1.1			Estimated contact of sand and gravel unit with underlying sand unit is at 82'. Some fine-grained yellowish-gray to olive gray sand is present around 82'; however due to drilling/sampling problems, the lithology between 81' and 86' is somewhat uncertain. At 86', sand is fine to coarse-grained, with some gravel (up to 2" in longest dimension).		
85					1.1		SW			
					0.6					
90					0.4		SC	(88-96') Cockfield Formation: Clayey, fine-grained sand, dark yellowish-orange.	82.3	

<i>EnSafe/Allen & Hoshall</i>										Log of Monitoring Well 015G03LF	
Project: NSA Memphis					Location: Millington, TN					SMU #15	
Project No.: 0094-08420					Surface Elevation: 280.29 feet msl						
Started at 1215 on 3-11-96					TOC Elevation: 282.55 feet msl						
Completed at 1600 on 3-11-96					Depth to Groundwater: 28.80 feet					Measured: 4/8/96	
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.					Groundwater Elevation: 256.35 feet msl						
Drilling Company: Alliance Environmental, Inc.					Total Depth: 96 feet						
Geologist: J. Kingsbury					Well Screen: 78 to 88 feet						

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-MSL)	WELL DIAGRAM
95			10	100	0.4		SC	Sand, fine-grained, olive-gray to moderate gray, with some clay stringers, wet.	88.3	 bentonite plug
					0.4		SC			
					0.4					
								Terminated soil boring at 96'.	84.3	
100										
105										
110										
115										
120										

EnSafe/Allen & Hoshall				Monitoring Well 015G03LF				GAMMA RAY LOG COUNTS PER SECOND				CASING TYPE: 2" PVC TOP OF LOG = GROUND SURFACE DATE LOGGED: 05/22/96	
Project: NSA Memphis Project No.: 0094-08480 Started at: 1216 on 3-11-96 Completed at: 1800 on 3-11-96 Drilling Method: Rotaroids - 4" core barrel inside 6" casing Drilling Company: Alliance Environmental, Inc. Geologist: J. Kingsbury				Location: Millington, TN. SWMU #16 Surface Elevation: 280.29 feet msl TOC Elevation: 282.66 feet msl Depth to Groundwater: 28.60 feet Measured: 4/8/96 Groundwater Elevation: 256.95 feet msl Total Depth: 86 feet Well Screen: 78 to 88 feet				NOTES					
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PD (ppm)	GRAINING LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM			
45			8	110	0.4		EP		234.3				
					0.4								
					0.4								
50					0.4		SC	Clayey sand, fine to medium-grained, mottled olive gray to reddish-brown in color, dense, with some iron concretions near 50'.					
			8	110	0.4				229.3				
					0.4								
					0.4		SW	Sand, fine to coarse-grained, yellowish-brown to yellowish-gray in color. With gravel from 55' to 58'. Coarsening from 51'-58'.					
55					0.4				224.3				
					0.4		SW	Sand and gravel, yellowish-gray in color.					
					0.4		SW	Silt and clay, yellowish-brown in color.	222.3				
60			7	110	0.4				221.3				
					0.4		SW	Sand, medium to coarse-grained, reddish-brown in color.					
					0.4				217.3				
65					0.4			Sand and gravel; sand is medium to coarse-grained, reddish-brown.					
					0.4			(66'-67') Reddish-brown to dark yellowish-orange in color.					
70					0.4								
			8	100	0.4								
					0.4								
75					0.4								
					0.4								
80					1.0								
					0.8								

RCRA FACILITY INVESTIGATION
NSA MEMPHIS

015G03LF

DWG DATE: 08/12/96 DWG NAME: 84GL153A

LOGGED BY:
GEOLOGICAL LOGGING
SYSTEMS

EnSafe/Allen & Hoshall		Monitoring Well 015G03LF		GAMMA RAY LOG		CASSING TYPE 2" PVC				
				COUNTS PER SECOND		TOP OF LOG = GROUND SURFACE				
						DATE LOGGED: 05/24/96				
						NOTES				
Project: NSA Memphis Project No.: 0094-08420 Started at: 1215 on 3-11-96 Completed at: 1800 on 3-11-96 Drilling Method: Rotacore - 4" core barrel inside 8" casing Drilling Company: Alliance Environmental, Inc. Geologist: J. Kingsbury		Location: Mullington, TN. SWMU #16 Surface Elevation: 280.29 feet msl TOC Elevation: 282.55 feet msl Depth to Groundwater: 28.80 feet Measured: 4/8/98 Groundwater Elevation: 256.55 feet msl Total Depth: 98 feet Well Screen: 78 to 88 feet								
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85			9	100	1.1		SW	Estimated contact of sand and gravel unit with underlying sand unit is at 82'. Some fine-grained yellowish-gray to olive gray sand is present around 82'; however due to drilling/sampling problems, the lithology between 81' and 88' is somewhat uncertain. At 88', sand is fine to coarse-grained, with some gravel (up to 2" in longest dimension).	198.3	
					1.1					
					0.8				192.3	
90			10	100	0.4		SC	(88-98') Cockfield Formation: Clayey, fine-grained sand, dark yellowish-orange.	189.3	
					0.4			Sand, fine-grained, olive-gray to moderate gray, with some clay stringers, wet.		
95					0.4		SC		184.3	
								Terminated soil boring at 98'.		
100										
105										
110										
115										
120										

RCRA FACILITY INVESTIGATION
NSA MEMPHIS

015G03LF

LOGGED BY:
GEOLOGICAL LOGGING
SYSTEMS

DWG DATE: 06/12/96

DWG NAME: 94GL153B


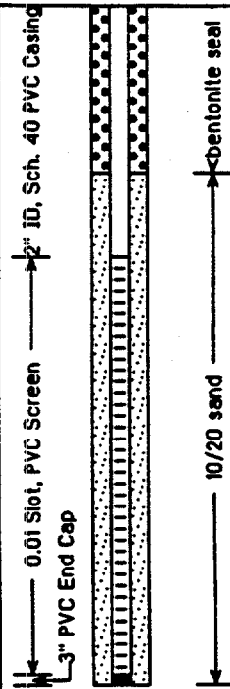


<i>EnSafe/Allen & Hoshall</i>								Log of Monitoring Well 015G04UF	
Project: NSA Memphis								Location: <i>Milington, TN</i> <i>SNMU #15</i>	
Project No: 0094-08420								Surface Elevation: <i>278.14 feet msl</i>	
Started at 0930 on 3-13-86								TOC Elevation: <i>280.55 feet msl</i>	
Completed at 1115 on 3-13-86								Depth to Groundwater: <i>24.64 feet</i> Measured: <i>4/8/86</i>	
Drilling Method: <i>Rotasonic - 4" core barrel inside 6" casing.</i>								Groundwater Elevation: <i>255.91 feet msl</i>	
Drilling Company: <i>Alliance Environmental, Inc.</i>								Total Depth: <i>46.25 feet</i>	
Geologist: <i>J. Kingsbury</i>								Well Screen: <i>36 to 46 feet</i>	

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
		▲	1					(0'-4') Hand augered. Silt, moderate brown to reddish-brown in color.		<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; height: 100%; position: relative;"> <div style="position: absolute; top: 0; right: -10px;">2" ID, Sch. 40 PVC Casing</div> <div style="position: absolute; bottom: 0; right: -10px;">grout</div> </div> <div style="border-left: 1px solid black; height: 100%; position: relative;"> <div style="position: absolute; bottom: 0; right: -10px;">tonite seal</div> </div> </div>
5		▲	2					Slightly clayey silt, light brown to yellowish-brown in color and mottled with yellowish-gray clay, moist.		
10								(10'-16') Some organics and iron-staining.		
15		▲	3				ML	(15'-16') Abundant iron-staining. (16'-20') Reddish-brown to light brown in color.		
20								(20'-26') Silt, minor clay, yellowish-brown with some yellowish-gray and dark orangish-yellow mottling.		
25										
							SM SC	(26'-28') Silt, brown, with fine-grained sand and clay.	262.1	
							SM SC	(28'-46') Fluvial Deposits. (28'-33') Sand, fine to medium-grained, with some silt and clay.	260.1	
30										

EnSafe/Allen & Hoshall

Log of Monitoring Well 015G04UF

Project: NSA Memphis	Location: <i>Millington, TN</i> SHMU #15
Project No: 0094-08420	Surface Elevation: 278.14 feet msl
Started at 0930 on 3-13-86	TOC Elevation: 280.55 feet msl
Completed at 1115 on 3-13-86	Depth to Groundwater: 24.64 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 255.91 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 46.25 feet
Geologist: J. Kingsbury	Well Screen: 36 to 46 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
							SM SC	(continued from previous page) Reddish-brown to light brown in color.		 <p>0.01 Slot, PVC Screen — 2" ID, Sch. 40 PVC Casing</p> <p>3" PVC End Cap</p> <p>10/20 sand</p> <p>bentonite seal</p>
35							SP	(33'-36') Sand, medium-grained. Yellowish-gray to dark yellowish-orange and pinkish-gray in color. Wet.	245.1	
40							SW	(36'-46') Sand, medium to coarse-grained, yellowish-gray to dark yellowish-orange and pinkish-gray.	242.1	
45								Soil boring terminated at 46'. Note: No samples were collected for lithologic description. Descriptions were transferred from the log for adjacent monitoring well 015G04LF.	232.1	
50										
55										
60										

Monitoring Well 015G04LF

Location: Millington, TN SHMU #15

Surface Elevation: 278.00 feet msl

TOC Elevation: 280.41 feet msl

Depth to Groundwater: 25.58 feet Measured: 4/8/96

Groundwater Elevation: 254.83 feet msl

Total Depth: 106 feet

Well Screen: 86 to 96 feet

Page 1 of 3

EnSafe/Allen & Hoshall

Monitoring Well 015G04LF

Project: NSA Memphis	Location: Millington, TN SMU #15
Project No: 0094-08420	Surface Elevation: 278.00 feet msl
Started at 1330 on 3-12-96	TOC Elevation: 280.41 feet msl
Completed at 1640 on 3-12-96	Depth to Groundwater: 25.58 feet Measured: 4/8/96
Drilling Method: Rotasonic - 4" core barrel inside 6" casing.	Groundwater Elevation: 254.83 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 106 feet
Geologist: J. Kingsbury	Well Screen: 86 to 96 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (gpm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
45			5	110	1.2			(46'-48') Sand is pinkish-gray to orangish-yellow in color and fine to medium-grained. Micaceous. (48'-59') Yellowish-gray to light gray in color. Micaceous.		
					1.2					
					1.4					
					1.4					
					3.8		SW			
50			6	110	5.3			(59'-66') Sand and gravel (pea-size to 1" in longest dimension). Yellowish-gray to brownish-gray in color. (64'-66') Increase in gravel fraction.	219	
					4.9					
					0.4					
55					5.8			(66'-69') Very coarse sand with some pea-size gravel. Dusky yellow in color.	212	
							SW GW			
60			7	100	3.1			(69'-70') Clay. Very light yellowish-gray in color.	209	
							SP		208	
65					0.4		CL	(70'-73') Sand, fine to medium-grained, pinkish-gray to yellowish-gray in color.	205	
							SW			
70			8	100	0.2			(73'-86') Sand (very coarse-grained) and gravel (up to 1" in longest dimension). Yellowish-gray to dusky yellow in color.		
							SP GW			
75					0.2					
80										

EnSafe/Allen & Hoshall

Monitoring Well 015G04LF

Project: NSA Memphis

Location: *Millington, TN* SHMU #15

Project No: 0094-08420

Surface Elevation: 278.00 feet msl

Started at 1330 on 3-12-96

TOC Elevation: 280.41 feet msl

Completed at 1640 on 3-12-96

Depth to Groundwater: 25.58 feet Measured: 4/8/96

Drilling Method: Rotasonic - 4" core barrel inside 6" casing.

Groundwater Elevation: 254.83 feet msl

Drilling Company: Alliance Environmental, Inc.

Total Depth: 106 feet

Geologist: J. Kingsbury

Well Screen: 86 to 96 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85			9	70	0.2		SP/GW			
90			10	100	0.2		SP	(86'-95') Sand, very coarse-grained, with some gravel, yellowish-gray to dusky yellow.	82	
95					0.2		SP	Sand becomes reddish-brown in color. Some gravel present.		
					0.2		SP	(94'-95') Iron-cemented sand.	83	
100			11	100	0.2		SP/GW	(95'-96') Sand and gravel.	82	
105					0.2		SP	(96-106') Cockfield Formation: Fine-grained sand, with a few thin lenses of brown stiff clay from 98' to 105'. Moderate gray. Between 105' and 106', color changes to reddish-brown and yellowish-orange with some gravel present (possibly carried down from above).		
110								Terminated soil boring at 106'.	72	
115										
120										

EnSafe/Allen & Hoshall

Log of Monitoring Well 007G05UC

Project: <i>NAS Memphis</i>	Location: <i>Memphis, TN</i>
Project No.: <i>ND094</i>	Surface Elevation: <i>282.67 feet msl</i>
Started at: <i>on 1-09-95</i>	TOC Elevation: <i>282.39 feet msl</i>
Completed at: <i>on 2-21-95</i>	Depth to Groundwater: <i>N/A feet</i> Measured: <i>3/31/95</i>
Drilling Method: <i>Rotasonic</i>	Groundwater Elevation: <i>N/A feet msl</i>
Drilling Company: <i>North Star Drilling</i>	Total Depth: <i>135.0 feet</i>
Geologist: <i>Jack Carmichael</i>	Well Screen: <i>122 to 132 feet</i>

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	P/D (bpm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
5			1		BG			Clayey silt, moderate brown to yellowish brown, trace of organics.		<p>2" ID, Sch. 40 PVC and 8" steel casing</p> <p>grout</p>
			2	75	BG					
			3		BG					
			4		BG					
10			5	80	BG					
			6		BG					
			7		BG					
15			8	100	BG		ML	Clayey silt, dark yellowish brown, stiff, hard.		
			9		BG					
20			10	90	BG					
			11		BG					
			12		BG					
25			13		BG					
			14		BG					
30			15	90	BG					

<i>EnSafe/Allen & Hoshall</i>										Log of Monitoring Well 007G05UC	
Project: <i>NAS Memphis</i>					Location: <i>Memphis, TN</i>						
Project No.: <i>N0084</i>					Surface Elevation: <i>282.67 feet msl</i>						
Started at on <i>1-09-85</i>					TOC Elevation: <i>282.39 feet msl</i>						
Completed at on <i>2-21-85</i>					Depth to Groundwater: <i>N/A feet</i>			Measured: <i>3/31/85</i>			
Drilling Method: <i>Rotasonic</i>					Groundwater Elevation: <i>N/A feet msl</i>						
Drilling Company: <i>North Star Drilling</i>					Total Depth: <i>135.0 feet</i>						
Geologist: <i>Jack Carmichael</i>					Well Screen: <i>122 to 132 feet</i>						

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
			16		BG		ML		250.2	<div style="border-left: 1px solid black; border-right: 1px solid black; height: 100%; position: relative;"> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> <div style="position: absolute; top: 0; right: 0; bottom: 0; left: 0; border-left: 1px solid black; border-right: 1px solid black;"></div> </div> <div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: small;"> 2" ID, Sch. 40 PVC and 8" steel casing grout </div>
35			17	90	BG		SC	Sandy clay, fine, medium light brown, soft, wet.		
			18		BG			Silty sand, medium, light brown, grayish orange to yellow gray.		
40			19		BG					
			20		BG					
			21		BG			Silty sand, medium, yellowish orange to light brown.		
45			22		BG					
			23		BG		GP	Sand, medium, micaceous, yellowish orange to light brown.	237.7	
			24		BG					
50			25		BG			Sand, medium, grayish orange, micaceous.		
			26		BG					
55			27	60	BG					
			28		BG					
			29		BG					
60			30		BG					

EnSafe/Allen & Hoshall

Log of Monitoring Well 007G05UC

Project: <i>NAS Memphis</i>	Location: <i>Memphis, TN</i>
Project No.: <i>N0094</i>	Surface Elevation: <i>282.67 feet msl</i>
Started at: <i>on 1-09-85</i>	TOC Elevation: <i>282.39 feet msl</i>
Completed at: <i>on 2-21-85</i>	Depth to Groundwater: <i>N/A feet</i> Measured: <i>3/31/85</i>
Drilling Method: <i>Rotasonic</i>	Groundwater Elevation: <i>N/A feet msl</i>
Drilling Company: <i>North Star Drilling</i>	Total Depth: <i>135.0 feet</i>
Geologist: <i>Jack Carmichael</i>	Well Screen: <i>122 to 132 feet</i>

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
65			31		BG					
			32		BG					
			33		BG					
			34		BG		GP	Gravelly sand, coarse to very coarse, dark yellowish orange.		
70			35		BG					
			36		BG					
			38		BG					
75			39	87.5	BG					
			40		BG					
			41		BG					
80			42		BG					
			43		BG		SC	Silty sand, fine, brownish gray, with thin dark yellow clay lenses.	208.7	
			44		BG					
			45		BG					
85			46		BG					
90										

2" ID, Sch. 40 PVC and 8" steel casing

grout

EnSafe/Allen & Hoshall

Log of Monitoring Well 007G05UC

Project: *NAS Memphis*

Location: *Memphis, TN*

Project No.: *N0094*

Surface Elevation: *282.67 feet msl*

Started at: *on 1-09-95*

TOC Elevation: *282.39 feet msl*

Completed at: *on 2-21-95*

Depth to Groundwater: *N/A feet*

Measured: *3/31/95*

Drilling Method: *Rotasonic*

Groundwater Elevation: *N/A feet msl*

Drilling Company: *North Star Drilling*

Total Depth: *135.0 feet*

Geologist: *Jack Carmichael*

Well Screen: *122 to 132 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
95			47		BG					
			48		BG					
			49	80	BG					
			50		BG					
100			51		BG			Sand, fine, brownish gray with dark yellow brown clay lenses.		
			52		BG					
			53		BG					
105			54		BG		SC			
			56		BG					
110			57		BG					
			58		BG					
			59		BG					
115			60	90	BG					
			61		BG					
120			62		BG			Clay, dusky brown, waxy, from 119' to 119.5'. Sand, fine, brownish gray with clay lenses described above.		


EnSafe/Allen & Hoshall

Log of Monitoring Well 007G05UC

Project: <i>NAS Memphis</i>	Location: <i>Memphis, TN</i>
Project No.: <i>N0094</i>	Surface Elevation: <i>282.67 feet msl</i>
Started at: <i>on 1-09-85</i>	TOC Elevation: <i>282.39 feet msl</i>
Completed at: <i>on 2-21-85</i>	Depth to Groundwater: <i>N/A feet</i> Measured: <i>3/31/85</i>
Drilling Method: <i>Rotasonic</i>	Groundwater Elevation: <i>N/A feet msl</i>
Drilling Company: <i>North Star Drilling</i>	Total Depth: <i>135.0 feet</i>
Geologist: <i>Jack Carmichael</i>	Well Screen: <i>122 to 132 feet</i>

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
125			63		BG		SC			
			64		BG					
			65		BG					
			66		BG				54.7	
130			67		BG		CL	Clay, dusky brown, waxy, mixed with lignitic sand.		
			68		BG					
			69		BG					
135				90				End of boring at 135'.	147.7	
140										
145										
150										

EnSafe/Allen & Hoshall				Monitoring Well 007G18LF				GAMMA RAY LOG COUNTS PER SECOND				CASING TYPE: 8" PVC TOP OF LOG = GROUND SURFACE DATE LOGGED: 05/22/96						
Project: NSA Memphis				Location: Murkington, TN. SWMU 7 - Building N-126								NOTES						
Project No.: 0094-08420				Surface Elevation: 277.80 feet msl														
Started at: 0745 on 3-19-96				TOC Elevation: 277.68 feet msl														
Completed at: 1000 on 3-19-96				Depth to Groundwater: 23.50 feet Measured: 4/2/96														
Drilling Method: Rotasonic				Groundwater Elevation: 254.08 feet msl														
Drilling Company: Alliance Environmental				Total Depth: 118.0 feet														
Geologist: J. Kingsbury				Well Screen: 90 to 100 feet														
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	P.D. (ppm)	COUNCIL LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM								
			1	100	80			(0'-36") Silt, see descriptions below.										
			2	87	80			(1'-2') Brown, with some clay.										
					80			(2'-8') Brown, with some clay and organic material.										
5					80			(6'-16') Brownish-gray to light brown with some dark yellowish-orange staining, with organic material to 16'.										
10			3	80				(16'-19') Yellowish-brown, moist.										
15							ML	(19'-28') Olive gray to greenish-gray.										
20																		
25			4	70				(28'-36") Yellowish-brown to yellowish-gray, with some clay.										
30																		
35									241.8									
40							CL	(36'-44") Clay and silt, with sandy zones and a few traces of gravel, orangish-gray to very light gray with some dark yellowish-orange staining. Fluvial deposits contact estimated at 43' based on geophysical log interpretation.										
											007G18LF				LOGGED BY: GEOLOGICAL LOGGING SYSTEMS			
											DWG DATE: 08/13/96				DWG NAME: 840L718			

EnSafe/Allen & Hoshall				Monitoring Well 007G18LF				GAMMA RAY LOG		CASING 1 1/2" 2" PVC	
								COUNTS PER SECOND		TOP OF LOG = GROUND SURFACE	
										DATE LOGGED 05/22/96	
										NOTES	
Project: NSA Memphis				Location: Millington, TN. SWMU 7 - Building N-120							
Project No.: 0084-08420				Surface Elevation: 277.80 feet msl							
Started at 0746 on 3-19-96				TOC Elevation: 277.68 feet msl							
Completed at 1000 on 3-19-96				Depth to Groundwater 23.60 feet Measured: 4/8/96							
Drilling Method: Rotasonic				Groundwater Elevation: 254.08 feet msl							
Drilling Company: Alliance Environmental				Total Depth: 116.0 feet							
Geologist: J. Kingsbury				Well Screen: 80 to 100 feet							
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft.-m)	WELL DIAGRAM	
45			5	120			ML		233.8		
							UC	(44'-46") Clay, sand, and gravel, very stiff and dense, dark yellowish-orange to orangish-gray.	231.8		
50							SW	(46'-56") Sand, fine to coarse-grained, yellowish-gray to yellowish-brown, with a trace of gravel.			
55			6	90			SW		219.8		
60							SW	(56'-66") Sand and gravel, reddish-brown to dark yellowish-orange. Gravel is (up to 1.5" in longest dimension), some interstitial clay present.			
65							SW		211.8		
70							SW	(66'-72") Sand fine to very coarse-grained, dark yellowish-brown to light reddish-brown.			
75			7	85			SW	(72'-79") Sand and gravel, brown to reddish-brown, gravel is (up to 2.5" in longest dimension), clayey from 72' to 79', iron cemented at 79'.	208.8		
80							SW	(79'-86") Sand and gravel, little or no clay, dark yellowish-orange to light reddish-brown.	198.8		
 RCRA FACILITY INVESTIGATION NSA MEMPHIS				007G18LF				LOGGED BY: GEOLOGICAL LOGGING SYSTEMS			
				DWG DATE: 08/13/96				DWG NAME: 94CL718A			

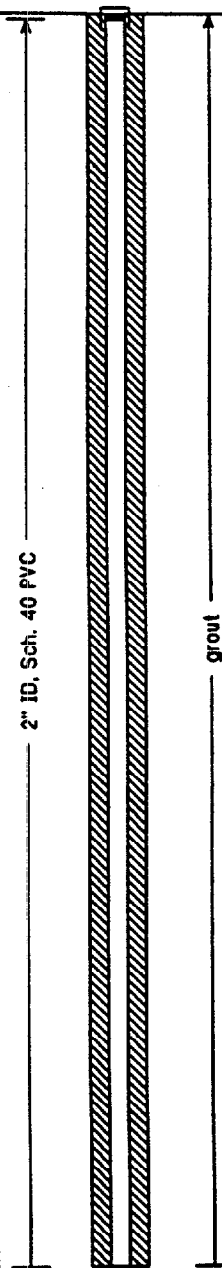
EnSafe/Allen & Hoshall		Monitoring Well 007G18LF		GAMMA RAY LOG COUNTS PER SECOND		CASING TYPE: 2" PVC TOP OF LOG = GROUND SURFACE DATE LOGGED: 03/22/96 NOTES				
Project: NSA Memphis Project No.: 0084-08420 Started at: 0745 on 3-18-96 Completed at: 1000 on 3-18-96 Drilling Method: Rotasonic Drilling Company: Alliance Environmental Geologist: J. Kingsbury		Location: Millington, TN. SWMU 7 - Building N-126 Surface Elevation: 277.80 feet msl TOC Elevation: 277.68 feet msl Depth to Groundwater: 25.60 feet Measured: 4/8/96 Groundwater Elevation: 254.08 feet msl Total Depth: 116.0 feet Well Screen: 80 to 100 feet								
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PPO (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft)	WELL DIAGRAM
85 90 95 100 105 110 115 120			8 9	120 110		GW SP	(88'-93') Gravel (up to 2.5" in longest dimension), with some sand, very slightly clayey, yellowish in color. (93'-100') Sand and gravel, reddish-brown to dark yellowish-orange. Cobble approximately 4" diameter near 100'. Cookfield Formation: Predominately fine-grained sand, gray, finely lignitic, with some thin stringers of clay throughout. Soil boring terminated at 116'.	181.8 184.8 177.8 161.8		
		007G18LF		LOGGED BY: GEOLOGICAL LOGGING SYSTEMS						
		DWG DATE: 03/13/96		DWG NAME: 94GL718B						

EnSafe/Allen & Hoshall

Log of Monitoring Well 007G18LF

Project: NSA Memphis	Location: Millington, TN SHMU 7 - Building N-126
Project No: 0094-08420	Surface Elevation: 277.80 feet msl
Started at 0745 on 3-19-96	TOC Elevation: 277.58 feet msl
Completed at 1000 on 3-19-96	Depth to Groundwater: 23.50 feet Measured: 4/8/96
Drilling Method: Rotasonic	Groundwater Elevation: 254.08 feet msl
Drilling Company: Alliance Environmental	Total Depth: 116.0 feet
Geologist: J. Kingsbury	Well Screen: 90 to 100 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
0			1	100	BG			(0'-36') Silt, see descriptions below.		
1			2	87	BG			(1'-2') Brown, with some clay.		
2					BG			(2'-6') Brown, with some clay and organic material.		
5					BG					
10			3	80	BG			(6'-16') Brownish-gray to light brown with some dark yellowish-orange staining, with organic material to 16'.		
15					BG					
20					BG		ML	(16'-19') Yellowish-brown, moist.		
25								(19'-28') Olive gray to greenish-gray.		
30			4	70						
35								(28'-36') Yellowish-brown to yellowish-gray, with some clay.		
40							CL ML	(36'-44') Clay and silt, with sandy zones and a few traces of gravel, orangish-gray to very light gray with some dark yellowish-orange staining. Fluvial deposits contact estimated at 43' based on geophysical log interpretation.	241.8	



EnSafe/Allen & Hoshall

Log of Monitoring Well 007G18LF

Project: NSA Memphis	Location: Millington, TN. SWMU 7 - Building N-26
Project No.: 0094-08420	Surface Elevation: 277.80 feet msl
Started at 0745 on 3-19-96	TOC Elevation: 277.58 feet msl
Completed at 1000 on 3-19-96	Depth to Groundwater: 23.50 feet Measured: 4/8/96
Drilling Method: Rotasonic	Groundwater Elevation: 254.08 feet msl
Drilling Company: Alliance Environmental	Total Depth: 118.0 feet
Geologist: J. Kingsbury	Well Screen: 80 to 100 feet

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
45			5	120			SP	(44'-46') Clay, sand, and gravel, very stiff and dense, dark yellowish-orange to orangish-gray.	233.8	
50							SW	(46'-58') Sand, fine to coarse-grained, yellowish-gray to yellowish-brown, with a trace of gravel.	231.8	
55			6	80			SW			
60							SH GW	(58'-66') Sand and gravel, reddish-brown to dark yellowish-orange. Gravel is (up to 1.5" in longest dimension), some interstitial clay present.	219.8	
65							SW	(66'-72') Sand fine to very coarse-grained, dark yellowish-brown to light reddish-brown.	211.8	
70							SW			
75			7	85			SC GW	(72'-79') Sand and gravel, brown to reddish-brown, gravel is (up to 2.5" in longest dimension), clayey from 72' to 79', iron cemented at 79'.	205.8	
80							SH GW	(79'-86') Sand and gravel, little or no clay, dark yellowish-orange to reddish-brown.	198.8	

EnSafe/Allen & Hoshall							Log of Monitoring Well 007G18LF			
Project: NSA Memphis							Location: <i>Mington, TN</i> <i>SWMU 7 - Building N-126</i>			
Project No: 0094-08420							Surface Elevation: 277.80 feet msl			
Started at 0745 on 3-19-96							TOC Elevation: 277.58 feet msl			
Completed at 1000 on 3-19-96							Depth to Groundwater: 23.50 feet Measured: 4/8/96			
Drilling Method: Rotasonic							Groundwater Elevation: 254.08 feet msl			
Drilling Company: Alliance Environmental							Total Depth: 116.0 feet			
Geologist: J. Kingsbury							Well Screen: 90 to 100 feet			
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85							SP			
90			8	120			GW	(88'-93') Gravel (up to 2.5" in longest dimension), with some sand, very slightly clayey, yellowish in color.	81.8	
95							GM	(93'-100') Sand and gravel, reddish-brown to dark yellowish-orange.	84.8	
100								Cobble approximately 4" diameter near 100'.	77.8	
105			9	110			SP	Cockfield Formation: Predominately fine-grained sand, gray, finely lignitic, with some thin stringers of clay throughout.		
110										
115										
120								Soil boring terminated at 116'.	81.8	

EnSafe/Allen & Hoshall						Boring 015S0021			
Project: NSA Memphis						Location: Millington, TN SHMU #15 (Soil Boring Only)			
Project No: 0094-08420						Geologist: A. Choate			
Started at 0820 on 3-13-86						Surface Elevation: 278.58 feet msl			
Completed at 1005 on 3-13-86						Drilling Method: Hollow-Stem Auger / 3" diameter split-spoon			
Total Depth: 17 feet						Drilling Company: Alliance Environmental, Inc.			
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	100	86		ML	(0'-1') Silt, tan to red in color, slightly moist with a trace of roots, soft. No samples collected from 1' to 6'.	278.6
5			2	100	85		ML	(6'-8') Clayey silt, olive gray to olive green in color. Moist and soft. No samples collected from 8' to 15'.	273.6 271.6
10									
15			3	100	73.8		ML	(15'-17') Silt, tan in color, soft, very moist to wet. From 16' to 17', silt becomes slightly clayey and is only slightly moist. Terminated soil boring at 17'.	264.6 262.6
20									
25									
30									
35									
40									

EnSafe/Allen & Hoshall						Boring 015S0022			
Project: NSA Memphis						Location: <i>Milington, TN SHMU #15 (Soil Boring Only)</i>			
Project No: 0094-08420						Geologist: <i>A. Choate</i>			
Started at 0825 on 3-13-86						Surface Elevation: <i>28121 feet msl</i>			
Completed at 0915 on 3-13-86						Drilling Method: <i>Hollow-Stem Auger / 3" diameter split spoon</i>			
Total Depth: <i>17 feet</i>						Drilling Company: <i>Alliance Environmental, Inc.</i>			
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
0			1	100	BG		ML SW	(0'-1') Silt and sand with gravel fill (up to 1" in longest dimension). Tan and red in color, moist. No samples collected from 1' to 6'.	2802
5			2	50	4.5		ML	(6'-8') Clayey silt, olive gray and tan in color, moist, soft. Slight petroleum odor present in sample. No samples collected from 8' to 15'.	2752 2732
10									
15			3	100	58.7		ML	(15'-17') Clayey silt, dark tan and olive gray in color, moist, soft. Slight petroleum odor present in sample. Terminated soil boring at 17'.	2682 2642
20									
25									
30									
35									
40									

EnSafe/Allen & Hoshall

Boring 015S0023

Project: NSA Memphis

Location: *Millington, TN SWMU #15 (Soil Boring Only)*

Project No.: 0094-08420

Geologist: A. Choate

Started at 1245 on 3-13-96










Surface Elevation: 278.29 feet msl

Completed at 1330 on 3-13-96

Drilling Method: *Hollow-Stem Auger/3" diameter split-spoon*

Total Depth: 17 feet

Drilling Company: *Alliance Environmental, Inc.*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
0			1	75	86		ML	(0'-2') Silt, tan in color, slightly moist, soft to slightly stiff. Trace of roots.	276.3
5								No sample collected between 2' and 6'.	
6			2	50	98.4		ML	(6'-8') Silt, mottled tan and olive gray in color, moist, very soft. Slight hydrocarbon odor.	272.3
10								No sample collected between 8' and 15'.	270.3
15			3	100	165		ML	(15'-17') Clayey silt, mottled tan and olive gray in color, slightly moist to moist. Slight hydrocarbon odor.	263.3
20								Terminated soil boring at 17'.	261.3
25									
30									
35									
40									

EnSafe/Allen & Hoshall

Boring 015S0024

Project: NSA Memphis

Location: Millington, TN. SHMU #15 (Soil Boring Only)

Project No.: 0094-08420

Geologist: A. Choate

Started at 1034 on 3-13-86

Surface Elevation: 278.00 feet msl

Completed at 1110 on 3-13-86

Drilling Method: Hollow-Stem Auger/3" diameter split-spoon

Total Depth: 17 feet

Drilling Company: Alliance Environmental, Inc.

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	75	BG		ML	(0'-2') Silt, reddish-brown to moderate brown in color, soft, slightly moist.	278
5								No sample collected between 2' and 6'.	
			2	88	23		ML	(6'-8') Silt, slightly clayey, tan in color with rare olive gray- colored pockets of material, firm, slightly moist. Slight petroleum odor.	272
10								No sample collected between 8' and 15'.	270
15			3	100	240		ML	(15'-17') Silt, slightly clayey, tan and olive gray in color, moist. Strong petroleum odor detected. Wet from 15.5' to 15.8'.	263
20								Soil boring terminated at 17'.	261
25									
30									
35									
40									

EnSafe/Allen & Hoshall

Boring 015S0025

Project: NSA Memphis

Location: Millington, TN. SHMU #15 (Soil Boring Only)

Project No.: 0094-08420

Geologist: A. Choate

Started at 1335 on 3-13-86

Surface Elevation: 278.11 feet msl

Completed at 1445 on 3-13-86

Drilling Method: Hollow-Stem Auger/3" diameter split-spoon

Total Depth: 17 feet

Drilling Company: Alliance Environmental, Inc.

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	83	2.7		ML	(0'-2') Silt, tan in color, slightly moist, stiff.	
5								No sample collected from 2' to 6'.	277.1
			2	100	189.3		ML	(6'-8') Silt, tan in color with some olive gray-colored silt pockets, moist to dry, very stiff.	273.1
10								No sample collected from 8' to 13'.	271.1
15			3	100				Collected Shelby Tube sample from 13' to 15'.	268.1
			4	100	9.8		ML	(15'-17') Silt, slightly clayey, tan in color, very soft to slightly stiff, dry to moist.	264.1
20								Terminated soil boring at 17'.	262.1
25									
30									
35									
40									



Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 05/07/96

Project No.: E-3-157

Client's Project No.: 0094-09000

Sample I.D.: 015S002515

Soil Description: Dark Brown Silty Clay

Test Media: City of Memphis Water

	<u>Pre-Test</u>	<u>Post Test</u>
Wet Density (Lbs/ft ³)	125.5	126.0
Dry Density (Lbs/ft ³)	101.5	100.6
Moisture (% Dry Wt)	23.7	25.3
Porosity (n)	.378	.383
Degree of Saturation (%)	.96	1.0
Specific Gravity (ASTM D-854)	2.61	---

Permeability

Temperature Correction, $R_t = 1.000$

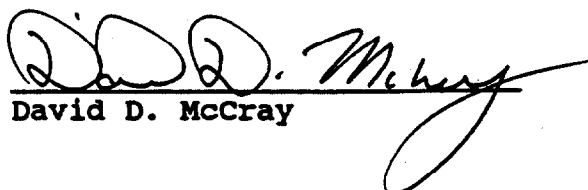
$$\begin{aligned}K_1 &= 6.3 \times 10^{-7} \text{ cm/sec} \\K_2 &= 4.3 \times 10^{-7} \text{ cm/sec} \\K_3 &= 4.8 \times 10^{-7} \text{ cm/sec} \\K_4 &= 4.6 \times 10^{-7} \text{ cm/sec}\end{aligned}$$

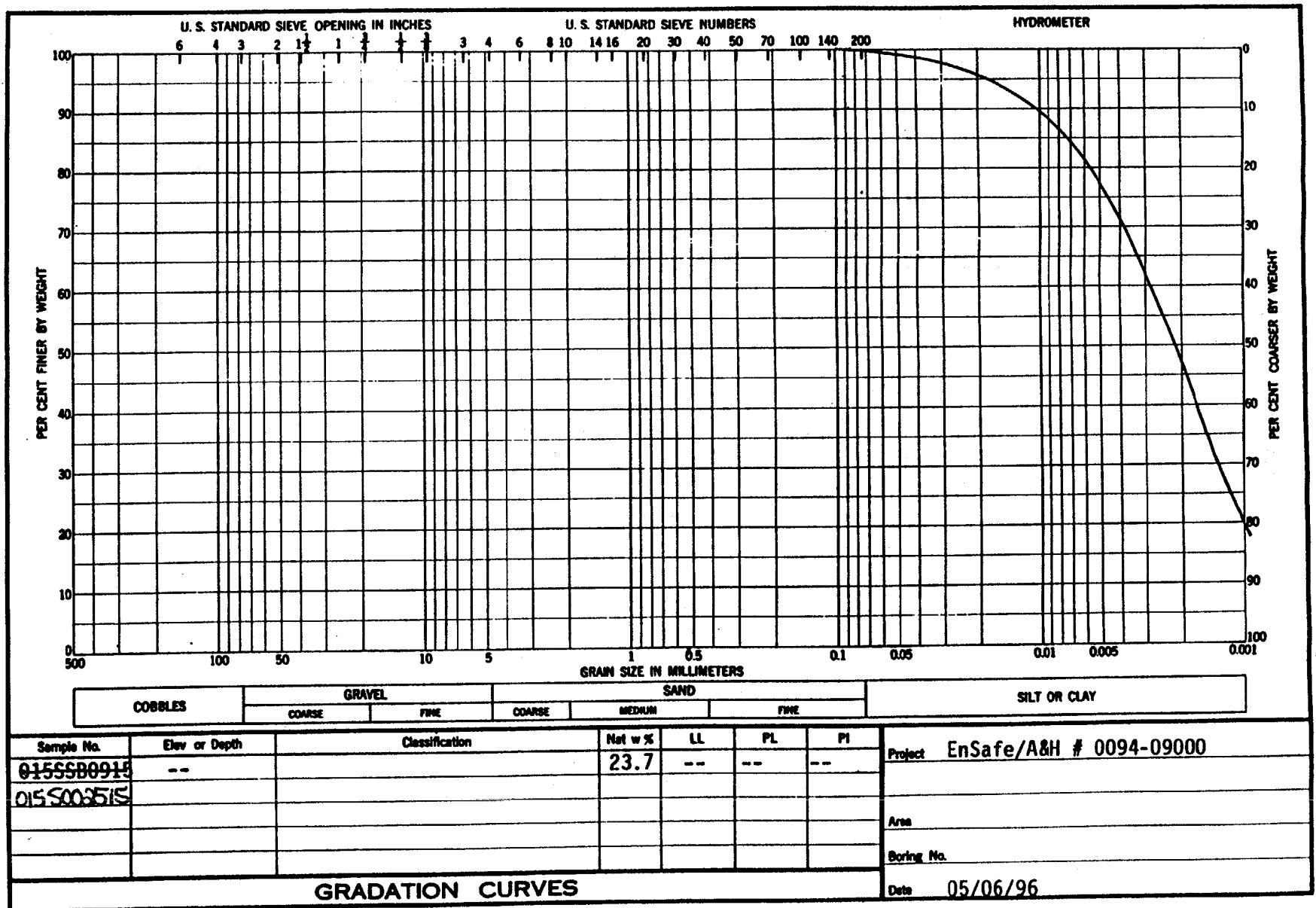
Coefficient of Permeability, $K_{20} = 5.0 \times 10^{-7} \text{ cm/sec}$

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-021

Reviewed By:


David D. McCray



Appendix B
Laboratory Results

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MEM26 APX9-METAL		SAMPLE ID ----->	016-S-0001-04	016-S-0002-04	016-S-0006-01	016-S-0007-01		
		ORIGINAL ID ----->	016S000104	016S000204	016S000601	016S000701		
		LAB SAMPLE ID ---->	S773876*3	S773876*4	S773876*1	S773876*2		
		SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97		
		DATE EXTRACTED -->	07/14/97	07/14/97	07/14/97	07/14/97		
		DATE ANALYZED ---->	07/15/97	07/15/97	07/15/97	07/15/97		
		MATRIX ----->	Soil	Soil	Soil	Soil		
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG		
CAS #	Parameter							
7440-36-0	Antimony (Sb)							
7440-38-2	Arsenic (As)	12.1	11.	11.8	62.1			
7440-39-3	Barium (Ba)	187.	233.	182.	139.			
7440-41-7	Beryllium (Be)	1.3	0.32 J	0.56 J	0.5 J			
7440-43-9	Cadmium (Cd)							
7440-47-3	Chromium (Cr)	16.5	12.2	17.1	12.5			
7440-48-4	Cobalt (Co)	19.1	10.	9.	8.4			
7440-50-8	Copper (Cu)	23.4	16.	19.	17.3			
7439-92-1	Lead (Pb)	16.9	14.3	26.8	20.2			
7439-97-6	Mercury (Hg)	0.05		0.03	0.03			
7440-02-0	Nickel (Ni)	36.3	13.3	16.	16.			
7782-49-2	Selenium (Se)							
7440-22-4	Silver (Ag)							
7440-28-0	Thallium (Tl)	0.26 J	0.18 J	0.31 J	0.16 J			
7440-62-2	Vanadium (V)	33.8	21.9	32.2	24.4			
7440-66-6	Zinc (Zn)	75.6 J	49.7 J	58. J	61.4 J			
7440-31-5	Tin (Sn)							

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MEM26 METAL-CN	SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	016-S-0006-01 016S000601 S773876*1 07/09/97 07/16/97 07/17/97 Soil MG/KG	016-S-0007-01 016S000701 S773876*2 07/09/97 07/16/97 07/17/97 Soil MG/KG				
CAS #	Parameter						
57-12-5	Cyanide (CN)						

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<p>MEM26 SUB46-HERB</p>	<p>SAMPLE ID -----> 016-S-0006-01 ORIGINAL ID -----> 016S000601 LAB SAMPLE ID ----> S773876*1 SAMPLE DATE -----> 07/09/97 DATE EXTRACTED --> 07/14/97 DATE ANALYZED ----> 07/22/97 MATRIX -----> Soil UNITS -----> UG/KG</p>	<p>016-S-0007-01 016S000701 S773876*2 07/09/97 07/14/97 07/21/97 Soil UG/KG</p>				
<p>CAS # Parameter</p>						
<p>94-75-7 2,4-D 94-82-6 2,4-DB 88-85-7 Dinoseb 93-76-5 2,4,5-T 93-72-1 2,4,5-TP (Silvex) 75-99-0 Dalapon 1918-00-9 Dicamba 120-36-5 Dichlorprop 94-74-6 MCPA 93-65-2 MCPP</p>		<p>5.3 J 6000.</p>				

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MEM26 SUB46-CP P	SAMPLE ID -----> 016-S-0006-01 ORIGINAL ID -----> 016S000601 LAB SAMPLE ID ----> S773876*1 SAMPLE DATE -----> 07/09/97 DATE EXTRACTED --> 07/14/97 DATE ANALYZED ----> 07/18/97 MATRIX -----> Soil UNITS -----> UG/KG	SAMPLE ID -----> 016-S-0007-01 ORIGINAL ID -----> 016S000701 LAB SAMPLE ID ----> S773876*2 SAMPLE DATE -----> 07/09/97 DATE EXTRACTED --> 07/14/97 DATE ANALYZED ----> 07/18/97 MATRIX -----> Soil UNITS -----> UG/KG				
CAS # Parameter						
86-50-0 Guthion 35400-43-2 Sulprofos 2921-88-2 Chloropyrifos 56-72-4 Coumaphos 8065-48-3 Demeton,O 333-41-5 Diazinon 62-73-7 Dichlorvos 298-04-4 Disulfoton 13194-48-4 Ethoprop 115-90-2 Fensulfothion 55-38-9 Fenthion 150-50-5 Merphos 300-76-5 Naled 298-00-0 Methyl parathion 298-02-2 Phorate 299-84-3 Ronnel 22248-79-9 Stirophos (Tetrachlorovinphos) 34643-46-4 Tokuthion 327-98-0 Trichloronate 126-75-0 Demeton,S 26718-65-0 Mevinphos						

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MEM26 SUB46-PEST	SAMPLE ID ----->	016-S-0006-01	016-S-0007-01				
	ORIGINAL ID ----->	016S000601	016S000701				
	LAB SAMPLE ID ---->	S773876*1	S773876*2				
	SAMPLE DATE ----->	07/09/97	07/09/97				
	DATE EXTRACTED -->	07/14/97	07/14/97				
	DATE ANALYZED ---->	07/24/97	07/24/97				
	MATRIX ----->	Soil	Soil				
	UNITS ----->	UG/KG	UG/KG				
CAS #	Parameter						
319-84-6	alpha-BHC						
319-85-7	beta-BHC						
319-86-8	delta-BHC						
58-89-9	gamma-BHC (Lindane)						
76-44-8	Heptachlor						
309-00-2	Aldrin						
1024-57-3	Heptachlor epoxide						
959-98-8	Endosulfan I	0.97 J	1.2 J				
60-57-1	Dieldrin	8.2	7.1				
72-55-9	4,4'-DDE						
72-20-8	Endrin						
33213-65-9	Endosulfan II						
72-54-8	4,4'-DDD						
1031-07-8	Endosulfan sulfate						
50-29-3	4,4'-DDT						
72-43-5	Methoxychlor	1.2 J					
7421-93-4	Endrin aldehyde						
8001-35-2	Toxaphene						
12674-11-2	Aroclor-1016						
11104-28-2	Aroclor-1221						
11141-16-5	Aroclor-1232						
53469-21-9	Aroclor-1242						
12672-29-6	Aroclor-1248						
11097-69-1	Aroclor-1254						
11096-82-5	Aroclor-1260						
57-74-9	Chlordane	4.5 J	6.2 J				

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MEM26 SUB46-SVOA		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED ---> DATE ANALYZED ---> MATRIX -----> UNITS ----->	016-S-0001-04 016S000104 S773876*3 07/09/97 07/14/97 07/17/97 Soil UG/KG	016-S-0002-04 016S000204 S773876*4 07/09/97 07/14/97 07/17/97 Soil UG/KG	016-S-0006-01 016S000601 S773876*1 07/09/97 07/18/97 07/22/97 Soil UG/KG	016-S-0007-01 016S000701 S773876*2 07/09/97 07/14/97 07/17/97 Soil UG/KG		
CAS #	Parameter							
108-95-2	Phenol							
111-44-4	bis(2-Chloroethyl) ether							
95-57-8	2-Chlorophenol							
541-73-1	1,3-Dichlorobenzene							
106-46-7	1,4-Dichlorobenzene							
95-50-1	1,2-Dichlorobenzene							
95-48-7	2-Methylphenol (o-Cresol)							
108-60-1	2,2'-oxybis(1-Chloropropane)							
621-64-7	N-Nitroso-di-n-propylamine							
67-72-1	Hexachloroethane							
98-95-3	Nitrobenzene							
78-59-1	Isophorone							
88-75-5	2-Nitrophenol							
105-67-9	2,4-Dimethylphenol							
120-83-2	2,4-Dichlorophenol							
120-82-1	1,2,4-Trichlorobenzene							
91-20-3	Naphthalene							
106-47-8	4-Chloroaniline							
87-68-3	Hexachlorobutadiene							
111-91-1	bis(2-Chloroethoxy)methane							
59-50-7	4-Chloro-3-methylphenol							
91-57-6	2-Methylnaphthalene							
77-47-4	Hexachlorocyclopentadiene							
88-06-2	2,4,6-Trichlorophenol							
95-95-4	2,4,5-Trichlorophenol							
91-58-7	2-Chloronaphthalene							
88-74-4	2-Nitroaniline							
131-11-3	Dimethyl phthalate							
208-96-8	Acenaphthylene							
606-20-2	2,6-Dinitrotoluene							
99-09-2	3-Nitroaniline							
83-32-9	Acenaphthene							
51-28-5	2,4-Dinitrophenol							
100-02-7	4-Nitrophenol							
132-64-9	Dibenzofuran							
121-14-2	2,4-Dinitrotoluene							
84-62-2	Diethylphthalate							

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MEN26 SMB46-SV0A		SAMPLE ID ----->	016-S-0001-04	016-S-0002-04	016-S-0006-01	016-S-0007-01		
		ORIGINAL ID ----->	016S000104	016S000204	016S000601	016S000701		
		LAB SAMPLE ID ----->	S773876*3	S773876*4	S773876*1	S773876*2		
		SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97		
		DATE EXTRACTED ----->	07/14/97	07/14/97	07/18/97	07/14/97		
		DATE ANALYZED ----->	07/17/97	07/17/97	07/22/97	07/17/97		
		MATRIX ----->	Soil	Soil	Soil	Soil		
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG		
CAS #	Parameter							
7005-72-3	4-Chlorophenylphenylether							
86-73-7	Fluorene							
100-01-6	4-Nitroaniline							
534-52-1	2-Methyl-4,6-Dinitrophenol							
86-30-6	N-Nitrosodiphenylamine							
101-55-3	4-Bromophenyl-phenylether							
118-74-1	Hexachlorobenzene							
87-86-5	Pentachlorophenol							
85-01-8	Phenanthrene							
120-12-7	Anthracene							
86-74-8	Carbazole							
84-74-2	Di-n-butylphthalate	51.	J					
206-44-0	Fluoranthene					26.	J	
129-00-0	Pyrene			8.6	J	19.	J	
85-68-7	Butylbenzylphthalate							
91-94-1	3,3'-Dichlorobenzidine							
56-55-3	Benzo(a)anthracene							
218-01-9	Chrysene							
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)							
117-84-0	Di-n-octyl phthalate							
205-99-2	Benzo(b)fluoranthene							
207-08-9	Benzo(k)fluoranthene							
50-32-8	Benzo(a)pyrene							
193-39-5	Indeno(1,2,3-cd)pyrene							
53-70-3	Dibenz(a,h)anthracene							
191-24-2	Benzo(g,h,i)perylene							
9999900-32-2	3-Methylphenol/4-Methylphenol							

*** Validation Complete ***

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MEM26 SUB46-VOA	SAMPLE ID ----->	016-S-0001-04	016-S-0002-04	016-S-0006-01	016-S-0007-01		
	ORIGINAL ID ----->	016S000104	016S000204	016S000601	016S000701		
	LAB SAMPLE ID ---->	S773876*3	S773876*4	S773876*1	S773876*2		
	SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97		
	DATE ANALYZED ---->	07/15/97	07/15/97	07/15/97	07/15/97		
	MATRIX ----->	Soil	Soil	Soil	Soil		
	UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG		
CAS #	Parameter						
74-87-3	Chloromethane						
74-83-9	Bromomethane						
75-01-4	Vinyl chloride						
75-00-3	Chloroethane						
75-09-2	Methylene chloride						
67-64-1	Acetone						
75-15-0	Carbon disulfide						
75-35-4	1,1-Dichloroethene						
75-34-3	1,1-Dichloroethane						
540-59-0	1,2-Dichloroethene (total)						
67-66-3	Chloroform						
107-06-2	1,2-Dichloroethane						
78-93-3	2-Butanone (MEK)						
71-55-6	1,1,1-Trichloroethane						
56-23-5	Carbon tetrachloride						
75-27-4	Bromodichloromethane						
78-87-5	1,2-Dichloropropane						
10061-01-5	cis-1,3-Dichloropropene						
79-01-6	Trichloroethene						
124-48-1	Dibromochloromethane						
79-00-5	1,1,2-Trichloroethane						
71-43-2	Benzene						
10061-02-6	trans-1,3-Dichloropropene						
75-25-2	Bromoform						
108-10-1	4-Methyl-2-Pentanone (MIBK)						
591-78-6	2-Hexanone						
127-18-4	Tetrachloroethene						
79-34-5	1,1,2,2-Tetrachloroethane						
108-88-3	Toluene						
108-90-7	Chlorobenzene						
100-41-4	Ethylbenzene						
100-42-5	Styrene						
1330-20-7	Xylene (Total)						

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MEM26 TPH	SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	016-S-0001-04 016S000104 S773876*3 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0002-04 016S000204 S773876*4 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0006-01 016S000601 S773876*1 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0007-01 016S000701 S773876*2 07/09/97 07/15/97 07/16/97 Soil MG/KG		
		A	A	A	A		
CAS #	Parameter						
9999900-02-4	Petroleum Hydrocarbons, TPH		300.	44.	18.		

*** Validation Complete ***

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MEN26 TPH-DRO		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	016-S-0001-04 016S000104 S773876*3 07/09/97 07/14/97 07/16/97 Soil MG/KG	016-S-0002-04 016S000204 S773876*4 07/09/97 07/14/97 07/16/97 Soil MG/KG	016-S-0006-01 016S000601 S773876*1 07/09/97 07/14/97 07/17/97 Soil MG/KG	016-S-0007-01 016S000701 S773876*2 07/09/97 07/14/97 07/17/97 Soil MG/KG		
CAS #	Parameter							
9999900-02-6	TPH - Diesel Range Organics		39.	5.	5.4			

*** Validation Complete ***

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MEM26 TPH-GRO	SAMPLE ID ----->	016-S-0001-04	016-S-0002-04	016-S-0006-01	016-S-0007-01		
	ORIGINAL ID ----->	016S000104	016S000204	016S000601	016S000701		
	LAB SAMPLE ID ---->	S773876*3	S773876*4	S773876*1	S773876*2		
	SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97		
	DATE ANALYZED ---->	07/22/97	07/22/97	07/22/97	07/22/97		
	MATRIX ----->	Soil	Soil	Soil	Soil		
	UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG		
CAS #	Parameter						
9999900-02-5	TPH - Gasoline Range Organics						

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MEN27 TPH	SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	016-S-0001-01 016S000101 S773876A*9 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0002-01 016S000201 S773876A*10 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0003-01 016S000301 S773876A*11 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0003-04 016S000304 S773876A*12 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0004-01 016S000401 S773876A*1 07/09/97 07/15/97 07/16/97 Soil MG/KG	016-S-0004-04 016S000404 S773876A*2 07/09/97 07/15/97 07/16/97 Soil MG/KG
		A	A	A	A	A	A
CAS #	Parameter						
9999900-02-4	Petroleum Hydrocarbons, TPH		990.	26.	11.	140.	150.

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MEM27 TPH	SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	016-S-0005-01 016S000501 S773876A*3 07/09/97 07/15/97 07/16/97 Soil MG/KG	A	016-C-0005-01 016C000501 S773876A*7 07/09/97 07/15/97 07/16/97 Soil MG/KG	A	016-S-0005-04 016S000504 S773876A*4 07/09/97 07/15/97 07/16/97 Soil MG/KG	A	016-S-0006-04 016S000604 S773876A*5 07/09/97 07/15/97 07/16/97 Soil MG/KG	A	016-C-0006-04 016C000604 S773876A*8 07/09/97 07/15/97 07/16/97 Soil MG/KG	A	016-S-0007-04 016S000704 S773876A*6 07/09/97 07/15/97 07/16/97 Soil MG/KG	A
CAS #	Parameter												
9999900-02-4	Petroleum Hydrocarbons, TPH	20.		20.		15.		15.		18.		1500.	

*** Validation Required ***

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MEN27 TPH-DRO	SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED --> MATRIX -----> UNITS ----->	016-S-0001-01	016-S-0002-01	016-S-0003-01	016-S-0003-04	016-S-0004-01	016-S-0004-04
		016S000101 S773876A*9 07/09/97 07/14/97 07/16/97 Soil MG/KG	016S000201 S773876A*10 07/09/97 07/14/97 07/18/97 Soil MG/KG	016S000301 S773876A*11 07/09/97 07/14/97 07/17/97 Soil MG/KG	016S000304 S773876A*12 07/09/97 07/14/97 07/16/97 Soil MG/KG	016S000401 S773876A*1 07/09/97 07/14/97 07/17/97 Soil MG/KG	016S000404 S773876A*2 07/09/97 07/14/97 07/17/97 Soil MG/KG
CAS #	Parameter						
9999900-02-6	TPH - Diesel Range Organics	5.4	510.	5.3			5.2

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MEN27 TPH-DRO	SAMPLE ID ----->	016-S-0005-01	016-C-0005-01	016-S-0005-04	016-S-0006-04	016-C-0006-04	016-S-0007-04
	ORIGINAL ID ----->	016S000501	016C000501	016S000504	016S000604	016C000604	016S000704
	LAB SAMPLE ID ----->	S773876A*3	S773876A*7	S773876A*4	S773876A*5	S773876A*8	S773876A*6
	SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97
	DATE EXTRACTED -->	07/14/97	07/14/97	07/14/97	07/14/97	07/14/97	07/14/97
	DATE ANALYZED -->	07/16/97	07/17/97	07/16/97	07/16/97	07/16/97	07/17/97
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->		MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
CAS #	Parameter						
9999900-02-6	TPH - Diesel Range Organics		5.5				1100.

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MEM27 TPH-GRO	SAMPLE ID ----->	016-S-0001-01	016-S-0002-01	016-S-0003-01	016-S-0003-04	016-S-0004-01	016-S-0004-04
	ORIGINAL ID ----->	016S000101	016S000201	016S000301	016S000304	016S000401	016S000404
	LAB SAMPLE ID ---->	S773876A*9	S773876A*10	S773876A*11	S773876A*12	S773876A*1	S773876A*2
	SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97
	DATE ANALYZED ---->	07/22/97	07/22/97	07/22/97	07/23/97	07/16/97	07/21/97
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
	UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
CAS #	Parameter						
9999900-02-5	TPH - Gasoline Range Organics						

DATA LCP2
12/15/97

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D

Page: 6
Time: 16:04

MEM27 TPH-GRO	SAMPLE ID ----->	016-S-0005-01	016-C-0005-01	016-S-0005-04	016-S-0006-04	016-C-0006-04	016-S-0007-04
	ORIGINAL ID ----->	016S000501	016C000501	016S000504	016S000604	016C000604	016S000704
	LAB SAMPLE ID ----->	S773876A*3	S773876A*7	S773876A*4	S773876A*5	S773876A*8	S773876A*6
	SAMPLE DATE ----->	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97	07/09/97
	DATE ANALYZED ----->	07/22/97	07/22/97	07/22/97	07/22/97	07/22/97	07/22/97
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
	UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
CAS #	Parameter						
9999900-02-5	TPH - Gasoline Range Organics						2.4

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Robert Smith

LOG NO: S7-73876A
Received: 11 JUL 97
Reported: 28 JUL 97

Ms. Charlene Thompson
Ensafe, Allen and Hoshall
5724 Summer Trees Dr.
Memphis, TN 38134

Client PO. No.: 2/REL#16

Project: CTO#0094-09000/NSA MEMPHIS-Assembly>D/RFI/SDG#MEM27

Sampled By: Client

Code: 165370729

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	SDG#		
73876A-1	016S000401	07-09-97/1250	MEM27		
73876A-2	016S000404	07-09-97/1256	MEM27		
73876A-3	016S000501	07-09-97/1452	MEM27		
73876A-4	016S000504	07-09-97/1457	MEM27		
73876A-5	016S000604	07-09-97/1515	MEM27		
PARAMETER	73876A-1	73876A-2	73876A-3	73876A-4	73876A-5
Petroleum Hydrocarbons					
Total Recoverable	140	150	20	15	15
Petroleum Hydrocarbons (418.1), mg/kg dw					
Preparation Date	07.15.97	07.15.97	07.15.97	07.15.97	07.15.97
Date Analyzed	07.16.97	07.16.97	07.16.97	07.16.97	07.16.97
Dilution factor	1.0	1.0	1.0	1.0	1.0
Batch ID	0715F	0715F	0715F	0715F	0715F
Diesel Range Organics (DRO)					
Hydrocarbons as DRO, mg/kg dw	5.0U	5.2	4.0U	5.0U	4.0U
Surrogate - Orthoterphenyl (OTP)	74 %	82 %	75 %	86 %	91 %
Date Extracted	07.14.97	07.14.97	07.14.97	07.14.97	07.14.97
Date Analyzed	07.17.97	07.17.97	07.16.97	07.16.97	07.16.97
Dilution factor	1.0	1.0	1.0	1.0	1.0
Batch ID	0714V	0714V	0714V	0714V	0714V

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	SDG#		
73876A-1	016S000401	07-09-97/1250	MEM27		
73876A-2	016S000404	07-09-97/1256	MEM27		
73876A-3	016S000501	07-09-97/1452	MEM27		
73876A-4	016S000504	07-09-97/1457	MEM27		
73876A-5	016S000604	07-09-97/1515	MEM27		
PARAMETER	73876A-1	73876A-2	73876A-3	73876A-4	73876A-5
Gasoline Range Organics (GRO)					
Hydrocarbons as GRO, mg/kg dw	0.21U	0.23U	0.20U	0.23U	0.18U
Surrogate -	67 %	74 %	70 %	68 %	93 %
a,a,a-Trifluorotoluene					
Date Analyzed	07.16.97	07.21.97	07.22.97	07.22.97	07.22.97
Dilution factor	1.0	1.0	1.0	1.0	1.0
Batch ID	0716B	0716B	0716B	0716B	0716B
Clock ID	1D0716	1D0721	1D0721	1D0721	1D0722
Percent Solids (160.3), %	85	79	89	79	97

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES				DATE/ TIME SAMPLED	SDG#
73876A-6	016S000704				07-09-97/0841	MEM27
73876A-7	016C000501				07-09-97/1452	MEM27
73876A-8	016C000604				07-09-97/1515	MEM27
73876A-9	016S000101				07-09-97/1222	MEM27
73876A-10	016S000201				07-09-97/1235	MEM27
PARAMETER	73876A-6	73876A-7	73876A-8	73876A-9	73876A-10	
Petroleum Hydrocarbons						
Total Recoverable	1500	20	18	10U	990	
Petroleum Hydrocarbons (418.1), mg/kg dw						
Preparation Date	07.15.97	07.15.97	07.15.97	07.15.97	07.15.97	
Date Analyzed	07.16.97	07.16.97	07.16.97	07.16.97	07.16.97	
Dilution factor	10	1.0	1.0	1.0	10	
Batch ID	0715F	0715F	0715F	0715F	0715F	
Diesel Range Organics (DRO)						
Hydrocarbons as DRO, mg/kg dw	1100	5.5	4.0U	5.4	510	
Surrogate - Orthoterphenyl (OTP)	0 %D	96 %	97 %	84 %	114 %	
Date Extracted	07.14.97	07.14.97	07.14.97	07.14.97	07.14.97	
Date Analyzed	07.17.97	07.17.97	07.16.97	07.16.97	07.18.97	
Dilution factor	20	1.0	1.0	1.0	5.0	
Batch ID	0714V	0714V	0714V	0714V	0714V	

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	SDG#		
73876A-6	016S000704	07-09-97/0841	MEM27		
73876A-7	016C000501	07-09-97/1452	MEM27		
73876A-8	016C000604	07-09-97/1515	MEM27		
73876A-9	016S000101	07-09-97/1222	MEM27		
73876A-10	016S000201	07-09-97/1235	MEM27		
PARAMETER	73876A-6	73876A-7	73876A-8	73876A-9	73876A-10
Gasoline Range Organics (GRO)					
Hydrocarbons as GRO, mg/kg dw	2.4	0.20U	0.19U	0.22U	0.20U
Surrogate -	96 %	58 %	62 %	89 %	68 %
a,a,a-Trifluorotoluene					
Date Analyzed	07.22.97	07.22.97	07.22.97	07.22.97	07.22.97
Dilution factor	5.0	1.0	1.0	1.0	1.0
Batch ID	0716B	0716B	0716B	0716B	0716B
Clock ID	1D0722	1D0721	1D0721	1D0721	1D0721
Percent Solids (160.3), %	81	90	96	83	88

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	SDG#
73876A-11	016S000301	07-09-97/1435	MEM27
73876A-12	016S000304	07-09-97/1440	MEM27
PARAMETER	73876A-11	73876A-12	
Petroleum Hydrocarbons			
Total Recoverable Petroleum Hydrocarbons (418.1), mg/kg dw	26	11	
Preparation Date	07.15.97	07.15.97	
Date Analyzed	07.16.97	07.16.97	
Dilution factor	1.0	1.0	
Batch ID	0715F	0715F	
Diesel Range Organics (DRO)			
Hydrocarbons as DRO, mg/kg dw	5.3	5.0U	
Surrogate - Orthoterphenyl (OTP)	95 %	85 %	
Date Extracted	07.14.97	07.14.97	
Date Analyzed	07.17.97	07.16.97	
Dilution factor	1.0	1.0	
Batch ID	0714V	0714V	
Gasoline Range Organics (GRO)			
Hydrocarbons as GRO, mg/kg dw	0.21U	0.23U	
Surrogate - a,a,a-Trifluorotoluene	61 %	95 %	
Date Analyzed	07.22.97	07.23.97	
Dilution factor	1.0	1.0	
Batch ID	0716B	0716B	
Clock ID	1D0722	1D0723	
Percent Solids (160.3), %	84	78	

Methods: EPA SW-846

Linda A. Wolfe

Linda A. Wolfe, Project Manager

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REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID				SDG#
MEM27-1	Method Blank				MEM27
MEM27-2	Method Blank				MEM27
MEM27-3	Method Blank				MEM27
MEM27-4	Method Blank				MEM27
PARAMETER	MEM27-1	MEM27-2	MEM27-3	MEM27-4	
Petroleum Hydrocarbons					
Total Recoverable	10U				
Petroleum Hydrocarbons (418.1), mg/kg dw					
Preparation Date	07.15.97				
Date Analyzed	07.16.97				
Dilution factor	1.0				
Batch ID	0715F				
Diesel Range Organics (DRO)					
Hydrocarbons as DRO, mg/kg	4.0U				
Surrogate - Orthoterphenyl (OTP)	88 %				
Date Extracted	07.14.97				
Date Analyzed	07.16.97				
Dilution factor	1.0				
Batch ID	0714V				
Gasoline Range Organics (GRO)					
Hydrocarbons as GRO, mg/kg dw	0.18U	0.18U	0.18U	0.18U	
Surrogate - a,a,a-Trifluorotoluene	100 %	93 %	100 %	100 %	
Date Analyzed	07.16.97	07.21.97	07.22.97	07.23.97	
Dilution factor	1.0	1.0	1.0	1.0	
Batch ID	0716B	0716B	0716B	0716B	
Clock ID	1D0716	1D0721	1D0722	1D0723	

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Sampled By: Client

Code: 165270729

Page 2

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SDG#
MEM27-1	Method Blank	MEM27
MEM27-2	Method Blank	MEM27
MEM27-3	Method Blank	MEM27
MEM27-4	Method Blank	MEM27
PARAMETER	MEM27-1 MEM27-2 MEM27-3 MEM27-4	

Methods: EPA SW-846

Linda A Wolfe
Linda A. Wolfe, Project Manager

Final Page Of Report

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Appendix C
Comprehensive Health and Safety Plan

7.0 COMPREHENSIVE HEALTH AND SAFETY PLAN (CHASP)

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) is being conducted at the Naval Air Station (NAS) Memphis, Tennessee. The purpose of this program is to assess the nature and extent of contamination at the site and to determine if follow-up action is required to maintain compliance with environmental regulations.

This Comprehensive Health and Safety Plan (CHASP) is applicable to field operations to be conducted during the RFI at NAS Memphis. The Navy project contract number with EnSafe/Allen & Hoshall (E/A&H) is N62467-89-D-0318. A Site-Specific Health and Safety Plan (SSHSP) will be developed and implemented to address site-specific activities and hazards.

The provisions of this plan are mandatory for E/A&H personnel and those personnel under contract to E/A&H or the Navy e.g., the United States Geological Survey (USGS) whose work responsibilities call for them to enter a work zone (See 7.3 Work Areas). Such personnel must read this plan and sign the plan acceptance form (See Attachment C) before starting site activities. In addition, such personnel will operate in accordance with the most current requirements of 29 CFR 1910.120, *Standards for Hazardous Waste Workers and Emergency Responders* (HAZWOPER). These regulations include the following provisions for employees exposed to hazardous substances, health hazards, or safety hazards: training as described in 120(e), medical surveillance as described in 120(f), and personal protective equipment (PPE) described in 120(g).

All non-E/A&H personnel present in E/A&H work areas shall either adopt and abide by this CHASP and the corresponding SSHSP or shall have their own safety plan which, at a minimum, meets the requirements of the E/A&H CHASP and SSHSP.

At least one person certified in CPR and First Aid will be present during field activities. In addition, the E/A&H employees that are onsite will be certified in CPR and First Aid.

7.1 Site Characterization

Upon review of available information, the following chemicals are representative of the types of chemical hazards (contamination) known or suspected to be present on NAS Memphis: benzene, toluene, ethylbenzene, xylene, polychlorinated biphenyls (PCBs), naphtha, waste oils, and cleaning solutions. SSHSPs shall be designed to protect workers from chemical hazards known or suspected to be present at a specific location. The following information will be included in the SSHSP:

- A site map displaying the location of planned work areas within the site
- The expected site-specific contaminants of concern and the (suspected) magnitude and scope of the situation
- Decontamination procedures
- A material safety data sheet (MSDS) for each contaminant known or expected of being present

7.1.1 Work Areas

Site control for all work areas will be established and maintained according to the recommendations in the EPA's *Interim Standard Operating Safety Guides*, Revised September, 1982. Three general zones of operation, each described below, will be established to reduce the potential for contaminant migration and risk of personnel exposure:

- The exclusion zone (EZ) or "hot zone"

- contamination reduction zone (CRZ), and the
- support zone (SZ)

Field personnel shall enter the SZ and don their PPE, then they will move through the CRZ and into the EZ. After completing their work or when taking a break they will leave the EZ through the CRZ, decontaminate themselves and their equipment, and leave the area through the SZ.

The exclusion zone is the area being investigated, sampled, or otherwise of interest. It is where chemical contamination is known or suspected to exist. The EZ includes the work area except for areas set aside as either the CRZ or SZ. The EZ will be defined and demarcated in the field; in the case of drilling, the EZ is typically about 50 feet in diameter with the borehole located in the middle.

Only authorized personnel that meet the training requirements of OSHA 29 CFR 1910.120 (40 hour HAZWOPER course/8-hour annual refresher course/24-hour supervised onsite training or equivalent) are permitted within the exclusion and contamination reduction zones. Documentation of these certifications will be maintained on site, as well as in the site trailer, at all times. Prior to entering the EZ, and at all times when in the EZ, all personnel shall be outfitted in and properly use all required PPE. A checkpoint may be established at the edge of the EZ to regulate the flow of personnel and equipment in and out of the area.

When using Level A, B, or C PPE, all personnel entering the EZ must use the "buddy system". All persons entering the EZ must be able to:

- Provide his or her partner with assistance
- Observe his or her partner for signs of chemical or heat exposure
- Periodically check the integrity of his or her partner's protective clothing
- Notify the shift supervisor, his representative, or others if emergency help is needed

Additionally, at least one person shall remain outside the EZ and have available at least the same level of PPE as those who entered the EZ. The person outside the EZ will provide logistical and safety support as needed.

The contamination reduction zone serves as a buffer between the EZ and the SZ and is intended to prevent the spread of contaminants from the work areas. All decontamination procedures will be conducted in this area. The CRZ shall be adjacent to and upwind of the EZ and include all decontamination stations. When leaving the SZ and entering the CRZ, personnel must be wearing the prescribed PPE. Exiting the CRZ requires the removal of all contaminants through compliance with established decontamination procedures as contained herein and in the corresponding SSHSP.

The support zone is the outermost area and is considered a non-contaminated or clean area. The support area will be equipped with an appropriate first-aid station and equipment to perform gross decontamination of health and safety equipment (e.g., air monitoring equipment). The SZ is adjacent to and upwind of the CRZ.

The actual location and boundary of work zones will be determined and demarcated in the field. Existing site conditions such as prevailing wind direction, location of utilities, roads, security, etc., shall be considered when determining zone locations.

Changes in meteorologic conditions or site conditions may necessitate relocating the CRZ or SZ. These conditions (e.g., wind direction, surface water run-off patterns, etc.) will be monitored at all times. A wind sock or similar device will be placed in a location visible to all site workers.

7.1.2 Work Area Access

A file will be maintained onsite that includes a current OSHA initial HAZWOPER training certificate (or copy) and an up-to-date refresher certificate for all employees involved in field activities. Employees that are unsure that a copy of their certificate is onsite shall bring a copy of their certificate with them and present it to the Site Health and Safety Officer before beginning field work. Personnel that fail to meet or abide by the criteria established in the CHASP or SSHSP shall be restricted from entering work areas.

Subcontractors, DOD oversight personnel, and other site visitors must provide the Site Health and Safety Officer with documentation showing that their HAZWOPER training is current and must agree to comply with this CHASP and the corresponding SSHSP or equivalent health and safety requirements prior to site entry. Personnel that fail to meet or abide by the criteria established in the CHASP or SSHSP shall be restricted from entering work areas.

The Site Health and Safety Officer may suspend site work and may instruct personnel to evacuate the area. Examples of situations when this may happen are:

- Site conditions have changed, for whatever reason, such that the SSHSP does not adequately address the current situation,
- Safety precautions being used are inadequate for the situation, or
- Personnel including E/A&H, subcontractors, visitors, or DOD are or may be exposed to an immediate health hazard.

7.1.3 Site History and Description

A review of the existing site data will be conducted to assess the potential hazards to be encountered by E/A&H and contractor personnel and addressed in the SSHSP. The location of NAS Memphis is shown on Figure 2-1, Vicinity Map.

7.2 Site Activities

Field activities to be conducted as part of this RFI (e.g., soil borings, well installations, and well development) are described in the E/A&H Comprehensive Sampling and Analysis Plan (CSAP). Specific health and safety procedures associated with specific activities, hazards, and/or sites are addressed in the appropriate SSHSP.

The Site Supervisor will manage the day-to-day field operations which includes assigning field staff to specific work tasks and coordinating any required logistical support. The Site Supervisor has the authority to suspend or postpone specific field operations if he or she believes that worker health and safety concerns have not been adequately addressed.

Certain activities present a level of hazard that must be dealt with on a case by case basis. These activities are neither covered by this CHASP nor by a SSHSP. Examples of such activities are: confined space entry; moving or sampling of unknown drums or containers; and entering excavations, trenches, or test pits that are more than three feet deep. Should the Project Manager or Site Supervisor deem it necessary to perform an activity such as those listed above, it is that person's responsibility to contact the Project Health and Safety Officer and request an addendum to the SSHSP specifying the health and safety procedures, training, and conditions necessary for undertaking that task. These activities are prohibited until the SSHSP addendum is reviewed, accepted, and implemented.

7.3 Chemical Hazards

Information about specific site chemical hazards will be provided in each SSHSP. Such information will include National Fire Protection Association (NFPA) ratings, symptoms of acute and chronic exposure, carcinogenicity, and OSHA permissible exposure limits (PELs). A table of exposure guidelines for expected site chemicals will be provided. Information in this table will include odor thresholds, OSHA PELs, American Conference of Governmental Industrial Hygienists threshold limit values (ACGIH TLVs), National Institute for Occupational Safety and

Health recommended exposure limits (NIOSH RELs), auto-ignition temperatures, and flammability ranges. Material Safety Data Sheets for these materials will be included in Attachment A of each SIP.

7.4 Operations and Physical Hazards

Field personnel should be aware of and act in a manner to minimize the dangers associated with physical hazards typically encountered during environmental investigations. These hazards include heat-related illnesses, uneven terrain, slippery surfaces, lifting, and use of heavy equipment. Electrical lines may be present either above or below ground, and underground gas lines may be present. Prior to the initiation of drilling activities, drilling locations must be cleared by the Naval Public Works Center (PWC).

Heavy equipment and drill rig operations will be conducted in accordance with the procedures outlined in Attachment A — *Drilling Safety Guide*, provided in this plan. Personnel conducting drill rig operations shall keep clear of all moving parts. To prevent entanglement with the drill rig, loose clothing shall not be worn. The Site Supervisor and Site Health and Safety Officer shall be aware of the potential for heat stress and other weather-related illnesses, and shall implement appropriate work regimens to minimize the likelihood of field personnel becoming ill. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling. When working in areas that support habitat for poisonous snakes, personnel shall wear protective chaps made of a heavy material designed to prevent snake bites to the legs.

7.5 Employee protection

Employee protection for this project includes standard safe work practices, NAS Memphis rules of conduct, PPE, personal decontamination procedures, equipment for extreme weather conditions, work limitations, and exposure evaluation.

7.5.1 Standard Safe Work Practices:

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the Site Health and Safety Officer.
- Hands and face must be thoroughly washed upon leaving the work area.
- No contact lenses will be worn in work areas while invasive actions are conducted.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces, or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.
- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to ensure that the drill rig boom does not touch or pass close to any overhead lines.

- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), the activity and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.
- Due to the flammable properties of some of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

7.5.2 NAS Memphis General Rules of Conduct:

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.
- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.
- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.
- Willfully damaging or destroying property or removing government records is forbidden.
- Misappropriation or unauthorized altering of any government records is forbidden.
- Securing government tools in a personal or contractor's tool box is forbidden.
- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc., is forbidden.

- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.
- Compliance with posted signs and notices is required.
- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.
- Fighting or threatening bodily harm to another is forbidden.
- Defacing any government property is forbidden.
- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes, and pants or slacks or coverall-type garments will be worn at all times on government property.
- All persons operating motor vehicles will obey all NAS Memphis traffic regulations.

7.5.3 Selection of Personal Protective Equipment

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on past experiences and sound safety practices.

Table 7-1
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level A	<ul style="list-style-type: none"> When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) When known atmospheres or potential situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. Where atmospheres are oxygen deficient. When the type(s) and or potential concentration of toxic substances are not known. 	<ul style="list-style-type: none"> Positive-pressure full facepiece self-contained breathing apparatus (SCBA) or positive-pressure supplied air respirator with escape SCBA. Fully-encapsulating chemical protective suit. Chemical-resistant inner and outer gloves. Steel toe and shank chemical resistant boots. Hard hat under suit. Two-way radios worn inside suit. Optional: coveralls, long cotton underwear, disposable protective suit, gloves and boots, over fully encapsulating suit.
Level B	<ul style="list-style-type: none"> When respiratory protection is warranted and cartridge respirators are not appropriate. Examples of these conditions are: When work areas contain less than 19.5 percent oxygen, When expected contaminants do not have appropriate warning properties e.g. vinyl chloride, or When cartridges are not available to protect against all contaminants of concern. 	<ul style="list-style-type: none"> Chemical resistant clothes, long sleeves, hooded, one or two pieces. Positive-pressure full facepiece supplied air breathing apparatus or airline system with a 30-minute escape bottle. Hard hat. Inner gloves and chemical resistant gloves. Steel toe and shank boots. Optional: coveralls and disposable outer boots.
Level C	<ul style="list-style-type: none"> When respiratory protection is warranted and cartridge respirators are appropriate. When work areas contain at least 19.5 percent oxygen. 	<ul style="list-style-type: none"> Chemical resistant clothes, long sleeves, hood optional, one or two pieces. Full-facepiece, air purifying respirator equipped with cartridges suitable for the hazard. Hard hat. Inner gloves and chemical resistant gloves. Steel toe and shank boots. Coveralls and disposable outer boots.

Table 7-1 Level of Protection and Criteria		
Level of Protection	Criteria for Use	Equipment
Level D	<ul style="list-style-type: none"> When level B or C is not indicated. When airborne particulates do not warrant respiratory protection. When work areas contain at least 19.5 percent oxygen. 	<ul style="list-style-type: none"> Inner gloves and chemical-resistant gloves needed to handle soil or water samples. Steel toe and shank boots. Hard hat (ANSI Z89.1-1969 standard). Eye protection (ANSI Z87.1-1968) standard. Optional: coveralls and disposable outer boots.

Notes:

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed.

Contraindications for use of Level A:

- Environmental measures contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body, (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(ii) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material are known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 mg/m³ or the total concentrations exceed the PEL of 15 mg/m³.

Level D protection will be chosen when measurements of atmospheric concentrations are less than 2 ppm above background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.

The Project Health and Safety Officer will determine the appropriate level of PPE prior to the initial entry based on the best available information. PPE requirements are subject to change as site information is updated or changes. The decision to upgrade or downgrade levels of PPE shall be made by the Project Health and Safety Officer.

Field activities which disturb soils will be initiated in Modified Level D protection except when stated otherwise in the SSHSP or site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consists of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel-toed and shank boots. Work coveralls (full length sleeves and pants) will be worn if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the levels of contamination detected in previous studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceeds 2 ppm above the background concentration in the breathing zone or if concentrations of any contaminant exceeds 50 percent of the OSHA PEL. See Table 7-1 for the specific criteria for use and the equipment required for each level of protection.

7.5.4 Air Monitoring

Previous site work indicates that workers may potentially be exposed to low concentrations of numerous chemicals including volatile organic compounds (VOCs), halogenated compounds, and combustible gases/vapors. Based on site history and existing sampling data, "worst case" contaminated areas will be identified prior to initiation of field activities.

Air monitoring using a photoionization detector (PID) and/or other appropriate sampling equipment will be conducted prior to beginning field activities at a new EZ and during ground disturbing activities. The PID will be field calibrated to measure VOCs relative to a 100 ppm

isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to determine the identification and approximate concentration of these compounds.

A combustible gas indicator (CGI) will be used during all soil borings and well installations. The CGI will be field calibrated to measure flammable gases relative to a 23 percent lower explosive limit (LEL) methane standard. Downhole CGI readings will be collected continuously during all soil disturbing operations. Field activities will immediately cease if downhole readings exceed 10 percent LEL. If CGI readings do not subside, a careful investigation and mapping of the area will be made. Operations may not proceed until readings are below 10 percent LEL. The area will be immediately evacuated and the situation re-evaluated to determine how to proceed.

If breathing zone levels exceed 2 ppm or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact both the Project Manager and the Project Health and Safety Officer. The Project Health and Safety Officer will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) See Table 7-1 for specific criteria for each protection level. Work shall not proceed until breathing zone levels return to background levels, and it is reasonably anticipated that breathing zone samples will stay approximately at background levels; or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

On a daily basis, PIDs, CGIs, and other monitoring equipment shall be calibrated or their proper function verified before being used. Throughout the day this equipment shall be periodically checked to ensure that it is working properly. A final calibration shall be conducted at the end of the work day at which time each instrument will be checked to ensure that it is free from surface contamination. Field staff shall record in their field notebooks the fact that they conducted these calibrations and checks and note whether the equipment was or was not functioning properly. When equipment is not functioning properly, it should be brought to the attention of the Site Supervisor or Site Health and Safety Officer who will arrange for repairs and/or replacement of that equipment as needed.

7.5.5 Procedures and Equipment for Extreme Weather Conditions

The seasonal climate in Memphis can be expected to be hot with high relative humidity in the summer months and moderately cold to extremely cold in the winter months. Therefore, heat-and-cold stress will be of concern for all personnel. Adverse weather conditions are important considerations in planning and conducting site operations. Extremes in hot and cold weather can cause physical discomfort, loss of efficiency, and personal injury.

7.5.5.1 Exposure to Hot Weather

Heat stress can result when the protective clothing decreases natural body ventilation even when temperatures are moderate. Various levels of personal protection may require wearing low permeability disposable suits, gloves, and boots which will prevent most natural body ventilation. Discomfort due to increased sweating and body temperature (heat stress) will be expected at the work site.

Heat stress is the metabolic and environmental heat to which an individual is exposed. The manifestations of heat strain are the adjustments made by an individual in response to the stress. The three most important categories of heat-induced illness are: heat exhaustion, heat cramps, and heat stroke. These disorders can occur when the normal responses to increased sweat

production are not adequate to meet the needs for body heat loss or when the temperature regulating mechanisms fail to function properly.

Heat exhaustion is a state of collapse brought about by an insufficient blood supply to the cerebral cortex portion of the brain. The crucial event is low blood pressure caused by inadequate heart output and widespread dilation of blood vessels.

Heat Exhaustion Factors — Factors which can lead to heat exhaustion are as follows:

- Increased dilation of blood vessels causing a decreased capacity of circulation to meet the demands for heat loss to the environment from exercise and from digestive activities.
- Decreased blood volume due to dehydration.
- Reduced blood volume due to lack of physical training, infection, intoxication (from industrial contaminants as well as from drinking alcohol), or heart failure.

Heat Exhaustion Symptoms — The symptoms include extreme weakness or fatigue, dizziness, nausea, or headache. More severe cases may also involve vomiting and possible unconsciousness. The skin becomes clammy and moist, the complexion pale, and the oral temperature stays normal or low, yet the rectal temperature is usually elevated (99.5°F - 101.3°F). Workers who are unacclimated run the highest risk.

Heat Exhaustion Treatment — In most cases, treatment of heat exhaustion is fairly simple. The victim will be moved to a cool place. If the victim is unconscious, medical assistance must be sought. Mild cases may experience immediate recovery; however, more severe cases may require several days care. No permanent effects have ever been reported.

Heat cramps result when the working muscles go into painful spasms. This may occur in people who perspire profusely in heat and who drink large quantities of water, but who fail to replace their bodies' salt. It is the low salt content in the blood that causes the cramping. The abdominal muscles as well as the muscles in the arms and legs may be affected. The cramps may appear during or even after work hours. Persons on a low sodium diet should not be given salt. A physician must be consulted for care of people with this condition.

Heat stroke is the most serious of the health problems that can arise while working in hot environments. It is caused by the breakdown of the thermo-regulatory system under conditions of stress. When this happens, perspiration stops, and the body can no longer regulate its own temperature.

Heat Stroke Symptoms — A heat stroke victim may be identified by hot, dry, and unusually red or spotted skin. The body core temperature can exceed 105°F. Mental confusion, irritability, and chills are common. These are all early warning signs of heat stroke; if the sufferer is not removed from the hot environment at once, more severe symptoms can follow, including unconsciousness, delirium, and convulsions, possibly ending in death.

Heat Stroke Treatment — Heat stroke must be treated as a major medical emergency; medical assistance must be summoned immediately.

Additional treatment:

- First aid must be administered.
- Individual must be moved to a cool location.
- Individual must be cooled through wetting, fanning, or immersion.

Care should be taken to avoid over-cooling and to begin treatment for shock by raising the legs. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

To reduce the potential for heat strokes:

- Drink plenty of fluids (to replace loss through sweating).
- Wear cotton undergarments to act as a wick to absorb moisture.
- Make adequate shelter available for taking rest breaks to cool off.

Additional Measures for Extremely Warm Weather:

- Wear cooling devices to aid in ventilation. (NOTE: the additional weight may affect efficiency.)
- Install portable showers or hose down facilities to cool clothing and body.
- Shift working hours to early morning and early evening. Avoid the hottest time of the day.
- Frequently rotate crews wearing protective clothing (if required).

7.5.5.2 Exposure to Cold Weather

Persons working outdoors in temperatures at or below freezing may experience frostbite or hypothermia. Extreme cold for a short time may cause severe injury to the surface of the body. Areas of the body that have a high surface-area-to volume ratio, such as fingers, toes, and ears, are the most susceptible.

Two factors influence the development of cold injury: ambient temperature and wind velocity. As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air, thus, on a cold day the body can cool quickly when PPE is removed and if a person has wet clothing underneath.

Frostbite is a condition in which the cold temperature forms ice crystals in the cells and tissues, dehydrating protoplasm and killing tissues. At the same time, circulation of the blood is blocked. Frostbite could lead to gangrene and amputation.

Frostbite damage occurs in several degrees:

- **Frost nip, or incipient frostbite is characterized by sudden whitening of the skin.**
- **When superficial frostbite occurs, the skin has a waxy or whitish look and is firm to the touch; however, the tissue underneath has retained its resiliency.**
- **In deep frostbite, the tissues are cold, pale, and solid. The injury is severe. In addition to frostbite, other physiological reactions to cold may be experienced as well. Trench foot, for example, may result from prolonged exposure to low temperatures near, though possibly above, freezing. Walking on the foot is very painful. In very severe cases, the flesh dies and the foot may have to be amputated. Immersion foot is very similar although it is less severe. Although amputation is unusual, some mobility of the limb is lost. Blisters may occur around the lips, nostrils, and eyelids.**

Chilblain (pernio), which is an inflammation of the hands and feet caused by exposure to cold and moisture, is characterized by a recurrent localized itching, swelling, and painful inflammation on the fingers, toes, or ears, produced by mild frostbite. Such a sequence produces severe spasms and is accompanied by pain.

Hypothermia occurs when the body loses heat faster than it can produce it. The initial reaction involves the constriction of blood vessels in the hands and feet in an attempt to conserve the heat. After the initial reaction, involuntary shivering begins in an attempt to produce more heat.

Temperature is only a relative factor in cases of hyperthermia. Cases of exposure have occurred in temperatures well above freezing. Humidity is another important factor. Moisture on the skin and clothing will allow body heat to escape many times faster than when the skin and clothing are dry.

Hypothermia occurs when the body's core temperature drops below 96°F. When this happens, the affected person becomes exhausted. He may begin to behave irrationally, move more slowly, stumble, and fall. The speech becomes weak and slurred. If these preliminary symptoms are allowed to pass untreated, stupor, collapse, and unconsciousness occur, possibly ending in death.

To reduce effects of cold exposure:

- **Stay dry.** When the temperature drops below 40°F, change perspiration soaked clothes frequently. When clothes get wet, they lose about 90 percent of their insulating value.
- **Beware of the wind.** A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. Wind refrigerates wet clothes. Wind multiplies the problems of staying dry.
- **Understand cold.** Most hypothermia cases develop in temperatures between 30°F and 50°F. Cold water running down the neck and legs or cold water held against the body by wet clothes causes hypothermia.
- **Have shelter available.** Make adequate dry, warm shelter available.
- **Provide warm drinks.**

- **Never ignore shivering.** Persistent shivering is a clear warning that a person is on the verge of hypothermia. Allow for the fact that exposure greatly reduces normal endurance. Warmth generated by physical activity may be the only factor preventing hypothermia.

7.5.6 Personal Decontamination

A CRZ will be established immediate to each sampling/boring site and will include a station for decontaminating equipment and personnel. The CRZ will be covered with sheets of 6-mil polyethylene (typically an area 20-feet by 20-feet is sufficient) with specific stations that will accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection if required.

As a general rule, equipment will be decontaminated using a soap and clean water wash solution. Equipment decontamination will be completed by personnel in Level D PPE. In the event of inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, all contaminated equipment will be wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Personnel working in the CRZ will be in one Level of PPE lower than personnel in the EZ. For example, if personnel in the EZ are in Level B, decon workers will be in Level C.

7.5.6.1 Personal Decontamination Procedures

The decontamination procedures, based on Level D protection, will consist of the following:

- **Brushing heavily soiled boots and rinsing outer gloves and boots with soap and water.**
- **Removing outer gloves and depositing them in a plastic-lined container.**
- **Removing outer chemical protective clothing.**

- Washing and rinsing inner gloves.
- Hard hats and eye protection should be washed thoroughly at the end of each work day with a soap and water solution.
- Disposable gloves and any disposable clothing will be disposed of in sealable bags and placed in a clearly labeled 55-gallon drum for disposal by the Navy.
- All field personnel are to be instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each work day. If higher levels of PPE are needed, adjustments will be made to these procedures and an amendment will be made to this CHASP.

All wastes (soil and water) generated during personal decontamination will be collected in clearly labelled 55-gallon drums. The drums will be labeled and characterized by E/A&H or USGS personnel for final disposal by the Navy.

7.5.6.2 Closure of the Personal Decontamination Station

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed of in a refuse container. Decontamination and rinse solutions will be placed in a clearly labeled 55-gallon drum for later analysis and disposal. All washtubs, pails, buckets, etc., will be washed, rinsed, and dried at the end of each workday.

7.5.7 Work Limitations

All site activities will be conducted during daylight hours only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as

specified in 29 CFR 1910.120(e). All supervisors must complete an additional 8 hours of training in site management. All personnel must complete an 8-hour refresher training course on an annual basis in order to continue working at the site.

7.5.8 Exposure Evaluation

All personnel scheduled for site activities will have had a baseline physical examination which includes a stressing exam of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel and urinalysis, and will have been declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated on an annual basis and upon termination of employment, as required by 29 CFR 1910.120(f). The content of the annual or termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or any job restrictions. The Site Health and Safety Manager will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

7.6 Medical Monitoring Program

All E/A&H or USGS personnel who enter hazardous-waste/spill sites or have the potential for exposure to hazardous materials from these sites must participate in the E/A&H Medical Monitoring Program or an equivalent program. The program is conducted by E/A&H's company doctor with the company Health and Safety Officer. The purpose of the program is to identify any pre-existing illnesses or problems that would put an employee at unusual risk

from certain exposures or respirators, and to monitor and evaluate exposure-related events where workers are involved in handling hazardous materials. Project managers should consult with the Health and Safety Officer and/or the company doctor concerning the scope of work and known or anticipated chemical hazards associated with each project.

F/A&H maintains the right to exclude certain individuals from particular jobs based on reports from the company doctor. The program will be reviewed on an annual basis to determine its effectiveness. The company doctor has been employed as an independent contractor to provide medical monitoring for E/A&H.

The doctor is responsible for the following aspects of the Medical Monitoring Program:

- Selection and quality assurance of medical and laboratory services involved in carrying out the monitoring program.
- Development of a uniform medical record.
- Record retention.
- Employee notification of examination results.
- Determination of content of the medical and biological monitoring programs.
- Record review and correlation between potential exposure and effect.
- Monitoring job-related illness and injury for each employee.

7.6.1 Preplacement Examinations

Each E/A&H employee will be given a preplacement examination: to identify any preexisting illness or problem that would put the employee at an unusual risk from certain exposures; to assure that each employee can safely use negative-pressure respirators; and to develop a database to assess any exposure-related events detected during periodic medical monitoring. Data accumulation will include variables such as age, sex, race, smoking history, prior employment history, and other conditions that might bear upon the occurrence of subsequent events once employment begins.

The preplacement examination includes:

- Occupational history including previous chemical and carcinogenic exposures.
- Medical history including demographic data, family history, personal habits, past medical history, and a review of current systems.
- Fertility history.
- Physical examination stressing the neurologic, cardiopulmonary, musculoskeletal, and dermatological systems.
- Physiological parameters including blood pressure and visual acuity testing.
- Pulmonary function testing including FVC, FEV₁, and FEV₂₅₋₇₅.
- Electrocardiogram.
- PA and lateral chest X-ray.

- A multi-chemistry panel including tests of kidney and liver function.
- Red blood cell cholinesterase.
- Audiogram.

The history, physiological parameters, X-ray, screening tests, and laboratory studies will be conducted before the physical examination. After the physical examination, the medical examiner will review the results of the examination and special studies with each employee and facilitate referral for further evaluation of abnormalities detected during this examination. The Site Health and Safety Officer will provide each employee with a written summary and detailed results of the examination along with identification of any job restrictions. Additional medical testing procedures (e.g., ophthalmology/optometric assessment, specialized audiometric testing, etc.) may be required at the discretion of E/A&H's attending physician.

7.6.2 Periodic and Exit Examinations

An examination and updated occupational history will be repeated annually and include:

- Updated occupational and medical history.
- Physical examination stressing the neurologic, cardiopulmonary, musculoskeletal, and dermatological systems.
- Pulmonary function testing including FVC, FEV1, and FEV 25-75.
- Multi-chemistry panel including tests of kidney and liver function.
- Urinalysis.

The company doctor will review the results of annual examination and exposure data and request further tests or issue medical clearances as appropriate. An examination will also be administered when an employee leaves the company. The company doctor will be consulted for the contents of the exam except when the employee has had an exam within 6 months, or when there has been no site work since the last examination.

7.6.3 Return-to-Work Examinations

After any job-related injury or illness, a medical examination is required to determine fitness for duty or to identify any job restrictions. The medical examiner will review the results of this back-to-work examination with the company doctor before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job-related injury requiring medical attention.

7.6.4 Confidentiality

Medical records will be maintained in a confidential manner so that only authorized persons will have access to the records. The authorized personnel will include medical staff of the joint venture or contract medical personnel, the individual, the individual's personal physician, or the individual's designated representative. Upon written request, the individual may obtain a copy of the medical file which will be provided within 15 days of the receipt of the written request. Information used for research, testing, statistical, or epidemiologic purposes will have all identifying data removed including the identity of the individual. Any medical information or findings obtained which do not affect the individual's job performance will not be made available to E/A&H in order to maintain the patient-physician confidentiality. Upon death, retirement, resignation, or other termination of services, the records will be retained by E/A&H or contracting physician.

7.7 Authorized Personnel

Personnel anticipated to be onsite at various times during site activities include:

- Principal-In-Charge — Dr. James Speakman (E/A&H)
- Task Order Manager — Mr. Lawson Anderson (E/A&H)
- Project Manager — Ms. Ginny Gray (E/A&H)
- Project Health & Safety Officer — Mr. Doug Petty (E/A&H)
- Field Environmental Scientist — Mr. Robert Smith (E/A&H)
- Field Geologist — Mr. Ben Brantley (E/A&H)
- Site Supervisor — To Be Determined
- Site Health & Safety Officer — To Be Determined
- Engineer-in-Charge — Mr. Mark Taylor (SOUTHDIR)
- Naval Air Station Memphis, Tennessee Site Contact — Ms. Tonya Barker

7.7.1 Responsibilities of Site Supervisor

The Site Supervisor will direct the site operations and, relative to health and safety, is responsible for assuring that:

- Field staff follow the CHASP, SSHSP, and other safety and health standard operating procedures (SOPs). Personnel that do not comply are retrained and/or instructed to leave the site and not allowed to return.
- Field staff have current HAZWOPER training.
- Field staff know who the Site Health and Safety Officer is.
- Field staff know the site-specific safety and health concerns.
- There is an adequate onsite supply of health and safety equipment.

- Field staff participate in the E/A&H Medical surveillance program (or in the case of subcontractors, an equivalent program).
- Field staff attend safety and health "kick-off" orientation and other site safety briefings.

The Site Supervisor is also responsible for assuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

7.7.2 Responsibilities of Site Health and Safety Officer

The responsibilities of the Site Health and Safety Officer include:

- Providing the Site Supervisor with technical input on site health and safety issues.
- Observing field personnel and reporting to the Site Supervisor on the effectiveness of the CHASP and SSHSP, and observing whether field staff are utilizing proper work practices and decontamination procedures.
- Reporting significant safety violations to the Project Manager and/or Project Health and Safety Officer.
- Conducting safety briefings during field activities.
- Assuring that a copy of the Health and Safety Plan is maintained onsite during all field activities.
- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel.

The Site Health and Safety Officer will have the following qualifications: (1) 40 hours OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific work tasks being conducted, and (4) shall be trained to use the air monitoring equipment; be able to interpret the data collected with the instruments; be familiar with symptoms of chemical exposure, heat stress, and cold exposure; and know the location and proper use of onsite safety equipment. He will also be familiar with this CHASP.

The position of Site Health and Safety Officer may rotate. Often, particularly on small projects, this function is not a full time responsibility. Rather, a member of the field team is selected to serve as the Site Health and Safety Officer during a particular task. When that task is completed and/or field staff change, the Site Health and Safety Officer may change as well.

The following criteria outline when the Site Health and Safety Officer will be replaced: (1) termination of employment, (2) end of work task, (3) end of shift, (4) sickness, (5) injury, or (6) death. The SAP calls for one work shift per day. If circumstances arise that require multiple work shifts, an alternate Site Health and Safety Officer will be designated.

7.7.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with the CHASP and SSHSP.
- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards and knowing what to do when these hazards are encountered.
- Being properly trained on PPE use, safe work practices, decontamination procedures to be followed, and emergency procedures and communications.

- Properly utilizing required PPE, including respiratory protective equipment.
- Having up to date HAZWOPER training and then providing the Site Supervisor with documentation that their training is current.
- Being an up to date participant in an acceptable medical surveillance program.
- Using the buddy system when wearing respiratory protective equipment. When working in Level C or higher, a third person shall be at the work area. This person shall be suitably equipped to provide logistical and safety support to the entry team.
- Being fit-tested and physically capable of using a respirator. Should the use of respiratory protection be required, then field workers shall not have facial hair which interferes with achieving a proper fit.

In addition, field staff should always be alert and use their senses (sight, smell, etc.) to identify and react to potentially dangerous situations. When working in the EZ, visual contact should be maintained between personnel and field personnel should be close enough to assist each other during an emergency. Procedures for leaving a contaminated area must be planned and implemented before going onsite in accordance with the SSHSP.

The number of personnel and equipment in the contaminated area should be kept to a minimum in order to achieve effective site operations. All visitors to the job site must comply with the SSHSP procedures. PPE may be modified for visitors depending on the situation. Modifications must be approved by the Project Health and Safety Officer.

7.8 Emergency Information

All hazardous-waste site activities present a potential risk to onsite personnel. During routine operations risk is minimized by establishing good work practices, staying alert, and by using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support service, Ms. Tonya Barker, NAS Memphis Site Contact, will be informed and the appropriate contact from the following list will be made:

Contact	Agency or Organization	Telephone
Tonya Barker	Naval Air Station, Memphis	(901) 873-5461/5462
Mark Taylor	SOUTHDIV Engineer-in-Charge	(803) 743-0573
Law Enforcement	NAS Memphis Base Security	9-911
Fire Department	NAS Memphis	9-911
Ambulance Service	Naval Hospital, Millington Navy Road	(901) 873-5801/5802 or 9-911
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911
Southern Poison Control Center	—	(901) 528-6048
Lawson Anderson	EnSafe/Allen & Hoshall Memphis, Tennessee	(901) 372-7962
Doug Petty	EnSafe/Allen & Hoshall	(901) 372-7962

Mark Taylor, SOUTHDIIV Engineer-in-Charge will be contacted after appropriate emergency measures have been initiated onsite.

7.8.1 Site Resources

Cellular telephones will be used for emergency use and communication/coordination with NAS Memphis. First aid and eye wash equipment will be available at the work area.

7.8.2 Emergency Procedures

Conditions which may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite, or if a condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the Site Health and Safety Officer.
- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately halt work and act according to the instructions provided by the Site Health and Safety Officer.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the Site Health and Safety Officer that indicate possible routes for upwind escape.

- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the Site Health and Safety Officer has evaluated the situation and provided the appropriate instructions to the field team.
- If an accident occurs, the Project Manager is to complete an Accident Report Form (See Attachment C) for submittal to the managing principal-in-charge of the project.
- If a member of the field crew suffers a personal injury, the Site Health and Safety Officer will call (901) 372-5211 or 9-911 (serious injury) to alert appropriate emergency response agencies, or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.
- If a member of the field crew suffers chemical exposure, the affected body areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the Site Health and Safety Officer should alert appropriate emergency response agencies or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (See Attachment B for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through MSDS in Attachment A of each SIP. Directions to the nearest emergency medical facility capable of providing general emergency medical assistance and treating chemical burns

are provided in Attachment B of this CHASP. Directions from individual sites to the NAS Memphis South Gate will be provided as Attachment B of each SIP.

7.9 Forms

The following forms will be used in implementing this CHASP:

Plan Acceptance Form
Plan Feedback Form
Exposure History Form
Accident Report Form

A SSHSP Plan Acceptance Form will be filled out by all employees working on the site before site activities begin. The Plan Feedback Form will be filled out by the Site Health and Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Attachment C of this plan.

All completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

Appendix D
Site-Specific Health and Safety Plan

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Attachment B	Health and Safety Plan Forms
Attachment C	Directions to Emergency Medical Facilities

1.0 INTRODUCTION

As part of the U.S. Navy Installation Restoration Program, the following Site-Specific Health and Safety Plan (SSHSP) has been prepared for the Voluntary Corrective Action (VCA) at Solid Waste Management Unit (SWMU) 16, N-94 Aboveground Waste Storage Tanks, at Naval Support Activity (NSA) Memphis, Millington, Tennessee. The purpose of the VCA is to remove and characterize contaminated soil associated with SWMU 16.

This plan is to be used in conjunction with the approved NSA Memphis Comprehensive Health and Safety Plan (CHASP) presented in Appendix C and taken from the *Comprehensive RFI Work Plan, Naval Air Station Memphis, Millington, Tennessee* (E/A&H, 1994). Copies of both this plan and the CHASP should be onsite during all field operations.

Applicability

Current Hazardous Waste and Emergency Response Operators (HAZWOPER) training certificates for EnSafe and EnSafe subcontractors anticipated to be conducting field work onsite, will be filed onsite and available for review. Individuals whose certifications are not on file, or those who have a more recent certificate (have attended a refresher course), will provide the Onsite Supervisor with a copy of their certificate before being allowed to enter a work area.

Current OSHA refresher training certificates will be available onsite for all employees involved in field activities. All subcontractors, Navy oversight personnel, and any other site visitors must provide health and safety certification with appropriate refresher course documentation prior to site entry.

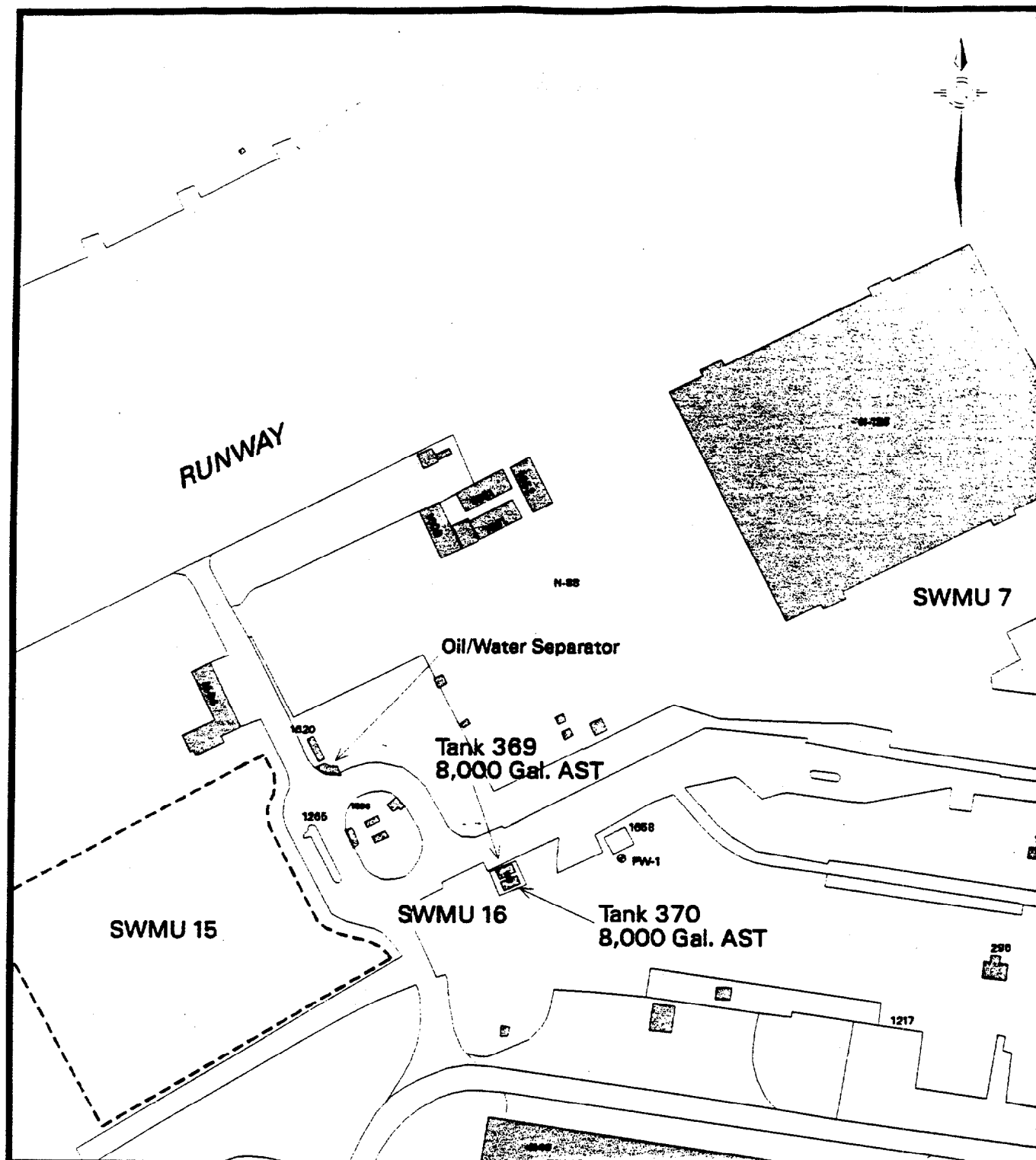
2.0 SITE CHARACTERIZATION

2.1 Site Description

SWMU 16 consists of two 8,000-gallon aboveground waste storage tanks approximately 900 feet east of the main runway and 300 feet northwest of Building N-16 on the NSA Memphis Northside. Figure 1 is a vicinity map of SWMU 16.

The two waste tanks (Tanks 369 and 370) stored petroleum products, waste fuels, and/or waste lubricating oil. Currently, Tank 369 contains waste oil, while Tank 370 has not been used for several months and is empty. The age of these tanks is unknown. Neither the tanks nor fill pipe area have an immediate secondary containment system; however, SWMU 16 is part of a larger area surrounded by a concrete berm. Due to the concrete berm, any water runoff or free-flowing product spills within SWMU 16 would be directed to an oil-water separator approximately 400 feet northwest of SWMU 16. A concrete road is adjacent to the north side of SWMU 16, while the south and east sides are bordered by grass areas and the west side is bordered by an area covered with gravel. Petroleum staining is presently visible in the adjacent grass and gravel areas. The *Visual Site Inspection* (ERC/EDGE, 1990a) report did not indicate a release at SWMU 16. According to the *RCRA Facility Assessment* (RFA) (ERC/EDGE, 1990b), representatives of the U.S. Navy, Tennessee Department of Environment and Conservation (TDEC), and U.S. Environmental Protection Agency (USEPA) Region IV recommended no further action at this SWMU.

A CSI was conducted at SWMU 16 in July 1997 to assess the nature of surface and subsurface soil contamination, determine the contaminants of concern, and estimate the extent of shallow contamination if a soil removal is warranted. During the CSI, fourteen shallow soil samples were collected from seven locations around the tanks. Results from the sampling identified that Appendix IX metals, herbicides, pesticides, SVOCs, and TPH are in surface and subsurface soil



LEGEND

● Production Well

0 feet 250



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 1
VICINITY MAP
SWMU 16

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at SWMU 16. However, except for TPH, concentrations of these constituents were either below USEPA industrial risk-based concentration (RBC) values (USEPA, 1989) or site background reference concentrations. One sample had a 1500 mg/kg TPH concentration that was above state regulatory action levels. The voluntary corrective action involves the removal of contaminated soil associated with this sample.

2.2 Work Areas

See Section 7.1.1 of the CHASP for a description of the following work zones:

- Exclusion Zone (EZ)
- Contaminant Reduction Zone (CRZ), and
- Support Zone (SZ).

For a description of field activities to be conducted at the site and within each work area see the VCA Work Plan.

2.3 Work Area Access

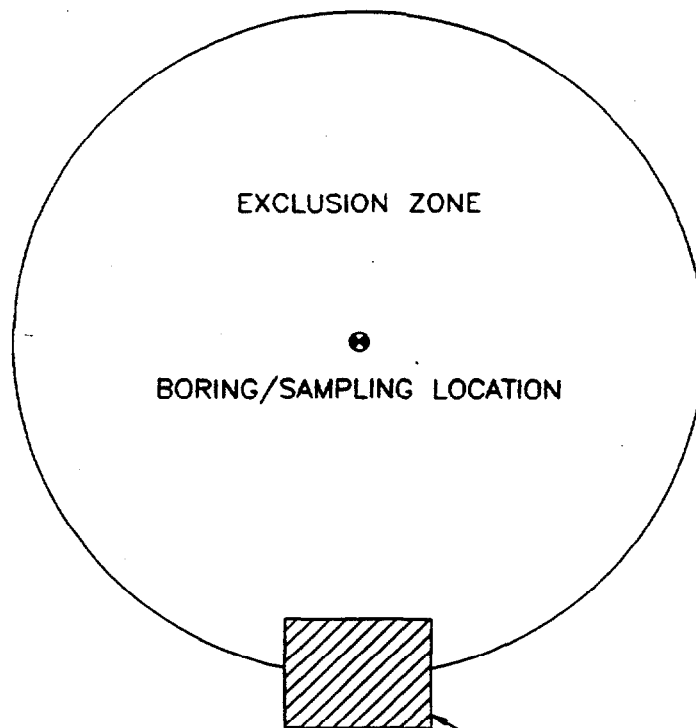
Authorized personnel will be allowed access to work areas as long as they follow the requirements of this SSHSP and the CHASP. See also Work Area Access, Section 7.1.2 of the CHASP.

2.4 Site Map and Work Zones

The location of the site is shown in Figure 1, the vicinity map. The work zone locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. Figure 2 shows a typical site work zone setup.

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EXCLUSION ZONE

BORING/SAMPLING LOCATION

CONTAMINATION
REDUCTION ZONE

SUPPORT ZONE

SCALE: NOT TO SCALE



RFI WORK PLAN
NSA MEMPHIS
MILLINGTON, TN

FIGURE 2
SITE WORK ZONES

DWG DATE: 06/26/96 | DWG NAME: 94SWZ

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3.0 SITE ACTIVITIES

Site activities will include soil sampling with hand augers. Field methods are described in the comprehensive RFI work plan.

4.0 CHEMICAL HAZARDS

The site history suggests a potential for exposure to chemicals. While no hazardous chemicals are known to be present at SWMU 16, the most likely chemicals of concern, based on the presence of the aboveground waste storage tank, are listed in Table 4-1, along with exposure guidelines, odor threshold, physical characteristics, symptoms of exposure, and flammability range.

Material Safety Data Sheets (MSDS) for these materials are included in Attachment A.

5.0 OPERATIONS AND PHYSICAL HAZARDS

Physical hazards typically encountered during environmental investigations will be present at this site. These hazards include heat-related illnesses, uneven terrain, slippery surfaces, lifting, and use of heavy equipment. The Site Supervisor and Site Health and Safety Officer (SHSO) shall be aware of the potential for heat stress and other weather-related illnesses, and as necessary, implement appropriate work regimens to minimize the likelihood of field personnel becoming ill.

Heavy equipment operations will be conducted in accordance with the procedures outlined in the CHASP, Attachment B, Drilling Safety Guide. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling. If working in areas supporting habitat for poisonous snakes, personnel should wear protective chaps made of a heavy material designed to prevent snake bites to the legs.

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Table 4-1
Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor ^(a) Threshold (ppm)	Physical Characteristics ^(a)	Symptoms of Exposure ^(a)	OSHA PEL [*] (ppm)	ACGIH TLV ^(d) (ppm)	Action Level ^(c) (ppm)	Flammable range ^(b) (% by volume)
Toluene	40	Colorless liquid with sweet, pungent, benzene-like odor.	Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest.	200 300 STEL	50	25	1.3 to 7.1
Hydraulic Fluid	N.A.	Colorless, oily liquid with odor like burned lubricating oil.	Irritate eyes, skin, and respiratory system.	5 mg/m ³	5 mg/m ³ 10 mg/m ³ STEL	2.5 mg/m ³	N.A.
PCBs	N.A.	Light yellow oily liquid or white solid powder with a weak odor.	Acne from skin contact	0.5 mg/m ³	0.5 mg/m ³ 1 mg/m ³ Skin	0.25 mg/m ³	N.A.
Cadmium	N.A.	Soft blue-white, malleable, lustrous metal; grayish-white powder.	Pulmonary edema, dyspnea, coughing, tight chest, substernal pain; headache, chills, muscle ache; nausea, vomiting, diarrhea, anosmia, emphysema; proteinuria, mild anemia.	0.05 mg/m ³	0.002 mg/m ³ - Respirable Fraction 0.01 mg/m ³ - Total Dust	0.01 mg/m ³	N.A.
Chromium	N.A.	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.	Irritate eyes, skin; histologic fibrosis of lungs.	1 mg/m ³	1 mg/m ³	0.25 mg/m ³	N.A.

Table 4-1
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor ^(a) Threshold (ppm)	Physical Characteristics ^(b)	Symptoms of Exposure ^(b)	OSHA PEL [*] (ppm)	ACGIH TLV ^(d) (ppm)	Action Level ^(c) (ppm)	Flammable range ⁽ⁿ⁾ (% by volume)
Lead	N.A.	Bluish-gray, soft metal; heavy ductile, soft, gray solid.	Encephalopathy; kidney disease; irritate eyes; hypotension, weakness, facial pallor, lassitude, insomnia, PAL, eye grounds, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia, gingival lead line; tremors, paralysis of wrist, ankles. Metallic taste; increased salivation, pyorrhea.	0.05 mg/m ³	0.15 mg/m ³	0.025 mg/m ³	N.A.
Diesel Fuel	N.A.	Clear liquid.	Produces dizziness, headache, nausea, and possibly irritation of the eyes, nose, and throat.	N.A.	N.A.	N.A.	0.7 to 7.5
Naphthalene	N.A.	White crystalline volatile solid with the odor of moth balls.	Skin irritation, nausea, vomiting, headaches, or dizziness.	10	10 15 STEL	5	0.9 to 5.9
Perchloroethylene	5	Clear, colorless, volatile liquid having an ether-like odor.	Causes central nervous system depression and liver damage. NIOSH considers it a potential human carcinogen.	25	25 100 STEL	12	N.A.

Table 4-1
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor ^(a) Threshold (ppm)	Physical Characteristics ^(b)	Symptoms of Exposure ^(b)	OSHA PEL* (ppm)	ACGIH TLV ^(d) (ppm)	Action Level ^(c) (ppm)	Flammable range ^(e) (% by volume)
Trichloroethylene	50	Clear, colorless, volatile liquid having a chloroform-like odor.	A narcotic, an irritant of skin and mucous membranes, a liver and kidney toxin, and is believed by NIOSH and EPA to be a potential human carcinogen.	50 200 STEL	50 100 STEL	12	8 to 10.5
Methylene chloride	214	Colorless liquid with a sweet, penetrating, ether-like odor	Suspected or potential carcinogen. Mild central nervous system depressant and an eye, skin, and respiratory tract irritant.	500 1000 STEL	50 Suspected human Carcinogen	25	13 to 23
Ethylbenzene	140	Colorless liquid with a sweet gasoline-like odor.	Irritation of nose, dizziness, depression. Moderate irritation of the eye with corneal injury possible. Irritates skin and may cause blisters.	100 125 STEL	100 125 STEL	50	1.0 to 6.7

Table 4-1
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor ^(a) Threshold (ppm)	Physical Characteristics ^(b)	Symptoms of Exposure ^(b)	OSHA PEL ^(c) (ppm)	ACGIH TLV ^(d) (ppm)	Action Level ^(e) (ppm)	Flammable range ^(f) (% by volume)
Benzene	4.68	Colorless to pale yellow watery liquid with a gasoline-like odor.	Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possibly death may result.	1 5 STEL	0.1 Confirmed Human Carcinogen	0.05	1.3 to 7.1
Xylene	Not Listed	Colorless liquid with aromatic odor.	Dizziness, excitement, drowsiness, staggering gait, irritate eyes, nose, and throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis.	100 150 STEL	100 150 STEL	50	1.0 to 7.0

Notes:

- ^a — Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values.
- ^b — Chemtox database, January 1996.
- ^c — 29 CFR 1910.1000, Table Z-1-A. Limits for Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit)
- ^d — 1990-1991 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienists (ACGIH).
- ^e — Action Level is the exposure limit at which personnel will implement engineering controls or upgrade levels of personal protective equipment. The Action Level is based on 50% of the PEL or TLV, whichever is lower.
- ^f — Flammable range is defined as the range between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL)
- N.A. — Substance information not available, or substance unlisted.
- mg/m³ — milligrams per cubic meter
- ppm — parts per million

6.0 EMPLOYEE PROTECTION

Employee protection for this project includes standard safe work practices, NSA Memphis rules of conduct, personal protective equipment (PPE), personal decontamination procedures, and equipment for extreme weather conditions, work limitations, and exposure evaluation.

6.1 Standard Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the SHSO.
- Hands and face must be thoroughly washed upon leaving the work area.
- No contact lenses will be worn in work areas while invasive actions are conducted.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate or discolored surfaces, or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances is present, unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.

- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to ensure that equipment such as a drill-rig boom does not touch or pass close to any overhead lines.
- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), NSA Memphis and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.
- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before site activities begin.

6.2 NSA Memphis General Rules of Conduct

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.
- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.
- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.
- Willfully damaging or destroying property, or removing government records is forbidden.
- Misappropriation or unauthorized altering of any government records is forbidden.

- Securing government tools in a personal or contractor tool box is forbidden.
- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc., is forbidden.
- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.
- Compliance with posted signs and notices is required.
- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.
- Fighting or threatening bodily harm to another is forbidden.
- Defacing any government property is forbidden.
- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes and pants or slacks, or coverall-type garments will be worn at all times on government property.
- All persons operating motor vehicles will obey all NSA Memphis traffic regulations.

6.3 Selection of Personal Protective Equipment

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on past experiences and sound safety practices.

The Project Health and Safety Officer (PHSO) will determine the appropriate level of PPE before the initial entry based on the best available information. PPE requirements are subject to change as site information is updated or changes. **The decision to upgrade or downgrade levels of PPE shall be made by the PHSO.**

Field activities that disturb soils will be initiated in modified Level D protection, except when stated otherwise in this plan or when site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consists of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel-toed and shank boots. Work coveralls (full length sleeves and pants) will be worn if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the concentrations of contamination detected in previous studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceed 5 parts per million (ppm) above the background concentration in the breathing zone or if the concentration of any contaminant exceeds 50 percent of the OSHA Permissible Exposure Limit (PEL). See Table 6-1 for the specific criteria for use and equipment for each level of protection.

Table 6-1
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level A	<ul style="list-style-type: none"> When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) When known atmospheres or potential situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. Where atmospheres are oxygen deficient with the conditions above When the type(s) and or potential concentration of toxic substances are not known 	<ul style="list-style-type: none"> Positive pressure-demand full facepiece; self-contained breathing apparatus (SCBA) or positive-pressure demand-supplied air respirator with escape SCBA Totally encapsulating chemical protective suit Chemical-resistant inner and outer gloves Steel-toe-and-shank chemical-resistant boots Hard hat under suit Two-way radios worn inside suit Coveralls, long cotton underwear, disposable protective suit, gloves and boots, worn over fully encapsulating suit
Level B	<ul style="list-style-type: none"> When work areas contain less than 19.5 percent oxygen When vinyl chloride is detected in the breathing zone 	<ul style="list-style-type: none"> Chemical-resistant clothes, long sleeves, hooded, one or two pieces Full-faced positive-pressure demand-supplied air breathing apparatus or airline system with a 30-minute escape bottle Hard hat Inner gloves and chemical-resistant gloves Steel-toe-and-shank boots Coveralls and disposable outer boots
Level C	<ul style="list-style-type: none"> When airborne dust particles warrant respiratory protection When work areas contain at least 19.5 percent oxygen 	<ul style="list-style-type: none"> Chemical-resistant clothes, long sleeves, hood optional, one or two pieces Full-face piece, air purifying respirator equipped with cartridges suitable for the hazard Hard hat Inner gloves and chemical-resistant gloves Steel-toe-and-shank boots Coveralls and disposable outer boots

Table 6-1
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level D	<ul style="list-style-type: none"> • When level B or C is not indicated • When airborne particles do not warrant respiratory protection • When work areas contain at least 19.5 percent oxygen 	<ul style="list-style-type: none"> • Inner gloves and chemical-resistant gloves needed to handle soil or water samples • Steel-toe-and-shank boots • Hard hat (ANSI Z891-1969 standard) • Eye protection (ANSI Z87.1-1968) standard • Sunscreen (SPF 15 or greater) • Coveralls and disposable outer boots

Notes:

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed. Level A protection will be required in Area A of the exclusion zone.

Contradictions for use of Level A:

- Environmental measures contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body, (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(I) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material are known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 mg/m³ or the total concentrations exceed the PEL of 15 mg/m³.

Level D protection will be chosen when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.

6.4 Air Monitoring

The PHSO reserves the right to require personal exposure monitoring or other types of air sample collection and analysis. These samples may be required for a variety of reasons including: photoionization detector (PID) or flame ionization detector (FID) readings exceed or approach the action level (AL), to determine if personal exposures are below OSHA PELs, or to identify a

chemical odor. Personal exposure monitoring will be conducted when site activities are conducted in PPE Level B or C. Sampling strategies will be designed to represent worst-case exposures. Samples typically are collected and analyzed using methods from the National Institute for Occupational Safety and Health (NIOSH) *Manual of Analytical Methods* (August 1994).

Air monitoring using a PID and/or other appropriate sampling equipment will be conducted before field activities begin at a new EZ and during ground-disturbing activities. The PID will be field calibrated, typically using a 100 ppm isobutylene standard. If volatile organic compounds (VOCs) are detected downhole, colorimetric detector tubes and/or other sampling media may be used to determine the identification and approximate concentration of these compounds.

Action Level

For this project, the AL is defined as the PID or FID reading in the breathing zone above which respiratory protection must be upgraded; chemical protective clothing may also be upgraded. The AL is determined on a site-by-site basis. To exceed the AL, PID or FID readings should be sustainable. Readings should remain above the AL for at least one or two minutes at a time. Readings that are elevated for only a few seconds every 15 or 20 minutes do not exceed the AL and do not require workers to upgrade their level of PPE.

For this SWMU, the AL, as determined on a properly calibrated PID or FID, is 5 PID or FID units above background. PPE shall be upgraded to Level C (assuming that cartridge respirators are appropriate, otherwise Level B) if airborne VOC concentrations in the breathing zone exceed the AL, or if any contaminant concentration exceeds 50 percent of the OSHA PEL.

If breathing zone levels exceed the AL, or if site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site

Supervisor of the situation and he/she shall contact the Task Order Manager (TOM) and/or the PHSO. The PHSO will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. See Table 6.1 for specific criteria for each protection level.

If PID or FID readings exceed 10 units, the SHSO shall contact the PHSO and discuss the need to identify and quantify airborne contaminants. Work shall not proceed until breathing zone concentrations return to background levels and it is reasonably anticipated that breathing zone readings will stay approximately at background levels, or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

Combustible Gas Meter

A combustible gas indicator (CGI) may be used during soil excavation. The CGI will be field-calibrated to measure flammable gases relative to a methane standard. Downhole CGI readings will be collected periodically during soil-disturbing operations. Field activities will immediately cease if downhole readings exceed 20 percent of the lower explosive limit (LEL). If CGI readings do not subside, the area will be immediately evacuated and the situation re-evaluated to determine how to proceed. The area will be investigated; operations may not proceed until downhole readings are below 20 percent LEL.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

PIDs, CGIs, and other monitoring equipment shall be calibrated daily or their proper function verified before being used. Throughout the day, this equipment shall be periodically checked to ensure that it is working properly. A final calibration shall be conducted at the end of the workday; at which time, each instrument will be checked to ensure that it is free from surface contamination. Field staff shall note in their field notebooks that they conducted these calibrations and checks and note whether the equipment functioned properly. Malfunctioning equipment should be brought to the attention of the Site Supervisor or SHSO, who will arrange to repair and/or replace that equipment as needed.

6.5 Severe Weather Conditions

Fieldwork shall not be conducted when lightning can be seen or thunder heard from the work area. When lightning and/or thunder occur, personnel should cease work, perform emergency personal and equipment decontamination (see Section 6.6) as needed, then seek shelter.

During extreme weather conditions, the Site Supervisor shall use his/her best judgment and has the authority to stop field work or dismiss workers for the day. Examples of conditions that may warrant work stoppage include: tornado warnings, hurricane warnings, high winds, hail, flooding, and ice storms.

For additional information on working in hot or cold environments see Section 7.5.5 of the CHASP.

6.6 Personal Decontamination

A CRZ will be established next to each sampling location and will include a station for decontaminating equipment and personnel. The CRZ will be covered with sheets of 6-mil polyethylene (typically an area 20 feet x 20 feet is sufficient) with specific stations to

accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection, if required.

As a general rule, equipment will be decontaminated using a soap and clean water wash solution. Equipment decontamination will be completed by personnel in Level D PPE. In the event of inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, all contaminated equipment will be wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Personnel working in the CRZ will be in one Level of PPE lower than personnel in the EZ. For example, if personnel in the EZ are in Level B, decontamination workers will be in Level C.

6.6.1 Personal Decontamination Procedures

The decontamination procedures, based on Level D protection, will consist of the following:

- Brushing heavily soiled boots and rinsing outer gloves and boots with soap and water.
- Removing outer gloves and depositing them in a labeled plastic-lined container.
- Removing outer chemical protective clothing.
- Washing and rinsing inner gloves.
- Washing hard hats and eye protection thoroughly at the end of each work day with a soap and water solution.

- Discarding disposable gloves and other disposable clothing in sealable bags in a labeled 55-gallon drum for disposal.
- All field personnel are to be instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each work day. If higher levels of PPE are needed, adjustments will be made to these procedures, and an amendment will be made to this SSHSP.

All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums labeled by EnSafe personnel for final disposal by the Navy.

6.6.2 Closure of the Personal Decontamination Station

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed of in a refuse container. Decontamination and rinse solutions will be placed in a labeled 55-gallon drum for later analysis and disposal. All washtubs, pails, buckets, etc., will be washed, rinsed, and dried at the end of each workday.

6.7 Work Limitations

All site activities will be conducted during daylight hours only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as specified in 29 CFR 1910.120(e). All supervisors must complete an additional 8 hours of training in site management. All personnel must complete an 8-hour refresher training course annually to continue working at the site.

6.8 Exposure Evaluation

All personnel scheduled for site activities will have had a baseline physical examination which includes a stressing exam of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel, and urinalysis, and have been declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated annually and upon termination of employment, as required by 29 CFR 1910.120(f). The annual or termination examination will cover the same areas as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or any job restrictions. The SHSO will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job-related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

7.0 MEDICAL MONITORING PROGRAM

See CHASP Section 7.6.

8.0 AUTHORIZED PERSONNEL

Personnel anticipated to be onsite at various times during site activities include:

- | | |
|-----------------------|--------------------------------|
| • Principal-In-Charge | — Dr. James Speakman (EnSafe) |
| • Task Order Manager | — Mr. Lawson Anderson (EnSafe) |

- Project Health and Safety Officer — Mr. Doug Petty (EnSafe)
- Site Supervisor — To Be Determined
- Site Health and Safety Officer — To Be Determined
- Engineer-in-Charge — Mr. Mark Taylor (SOUTHDIIV)
- NSA Memphis Site Contact — Mr. Rob Williamson

8.1 Responsibilities of Site Supervisor

The Site Supervisor will direct the site operations and, relative to health and safety, is responsible for assuring that:

- Field staff follow the CHASP, SSHSP, and other safety and health standard operating procedures (SOPs). Personnel who do not comply are retrained and/or instructed to leave the site and not allowed to return.
- Field staff have current HAZWOPER training.
- Field staff know who the SHSO is.
- Field staff know the site-specific safety and health concerns.
- There is an adequate onsite supply of health and safety equipment.
- Field staff participate in the EnSafe medical surveillance program (or in the case of the subcontractors, an equivalent program).
- Field staff attend safety and health "kick-off" orientation and other site safety briefings.
- Maintaining all necessary log books.

The Site Supervisor is also responsible for assuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

8.2 Responsibilities of SHSO

The responsibilities of the SHSO include:

- Providing the Site Supervisor technical input on site health and safety issues.
- Observing field personnel and reporting to the Site Supervisor on the effectiveness of the CHASP and SSHSP and whether field staff are using proper work practices and decontamination procedures.
- Reporting significant safety violations to the TOM and/or PHSO.
- Conducting safety briefings during field activities.
- Assuring that copies of the CHASP and SSHSP are maintained onsite during all field activities.
- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel.

The SHSO will have the following qualifications: (1) 40 hours OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific work tasks being conducted, and (4) training in the use of air monitoring equipment; ability to interpret the data collected with the instruments; familiarity

with symptoms of chemical exposure, heat stress and cold exposure, and knowledge of the location and proper use of onsite safety equipment. He will also be familiar with the CHASP and SSHSP.

The position of SHSO may rotate. Often, particularly on small projects, this function is not a full-time responsibility. Rather a member of the field team is selected to serve as the SHSO. Then when the field task is completed and/or field staff change, the SHSO may change as well.

The following criteria outline when the SHSO will be replaced: (1) termination of employment, (2) end of work task, (3) end of shift, (4) sickness, (5) injury, or (6) death. Under site work schedules, only one shift will be working. As a result, the SHSO will be responsible for the day shift. If circumstances arise that require work during other periods, an alternate SHSO will be designated.

8.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with the CHASP and this SSHSP.
- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards, and what to do when these hazards are encountered.
- Being properly trained on PPE to be used, safety work practices, decontamination procedures to be followed, and emergency procedures and communications.
- Using required PPE, including respiratory protection.

- Having up-to-date HAZWOPER training and providing the Site Supervisor with documentation that their training is current.
- Being an up-to-date participant in an acceptable medical surveillance program.
- Being fit-tested and physically capable of using a respirator and being in a position where using a respirator may be a requirement. If the use of respiratory protection is required, field workers shall not have facial hair which intrudes into the respirator sealing surface.
- Using the buddy system when wearing respiratory protective equipment. When working in Level C or higher, a third person shall be at the work area. This person shall be suitably equipped to provide logistical and safety support to the entry team.

In addition, field staff should always be alert and use their senses (sight, smell, etc.) to identify and react to potentially dangerous situations. When working in the EZ, visual contact should be maintained between personnel; field personnel should be close enough to assist each other during an emergency. Procedures for leaving a contaminated area must be planned and implemented before going onsite in accordance with the CHASP and SSHSP.

The number of personnel and equipment in the contaminated area should be kept to a minimum, consistent with effective site operations. All visitors to the job site must comply with the CHASP and SSHSP procedures. PPE may be modified for visitors, depending on the situation. Modifications must be approved by the PHSO.

9.0 EMERGENCY INFORMATION

All hazardous waste site activities present a potential risk to onsite personnel. During routine operations, risk is reduced by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support service, Rob Williamson, the NSA Memphis Site Contact, will be informed and the appropriate contact from the following list will be made:

Contact	Agency or Organization	Telephone
Rob Williamson	NSA Memphis	(901) 874-5461/5462
Mark Taylor	SOUTHDIV EIC	(803) 820-5573
Law Enforcement	NSA Memphis Security	9-911
Fire Department	NSA Memphis	9-911
Ambulance Service	Naval Hospital, Millington Navy Road	(901) 874-5801/5802 or 9-911
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911
Southern Poison Control Center	—	(901) 528-6048
Lawson Anderson	EnSafe/Allen & Hoshall	(901) 372-7962
Doug Petty	EnSafe/Allen & Hoshall	(901) 372-7962

In an emergency, dialing 911 on a cellular phone will reach the local, nonmilitary response center. If an NSA Memphis phone is used, 9-911 will reach Naval security. In an emergency, it is important to contact emergency personnel using the closest available phone, let the operator know where you are, what the situation is, and provide additional information as requested and based on your knowledge. Stay on the phone until they hang up or tell you to hang up.

Mark Taylor, SOUTHDIV Engineer-in-Charge (EIC) will be contacted after appropriate emergency measures have been initiated onsite.

9.1 Site Resources

Cellular telephones or the telephone at the nearby municipal airport operation (Building N-126 hangar) will be used for emergencies and communication/coordination with NSA Memphis. First-aid and eye-wash equipment will be available at the work area.

9.2 Emergency Procedures

Conditions which may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite, or the discovery of a condition that suggests a situation is more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the SHSO. Copies of emergency contacts and routes will be posted onsite.

- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately stop work and act according to the instructions provided by the SHSO.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the SHSO to indicate possible routes for upwind escape.
- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the SHSO has evaluated the situation and provided the appropriate instructions to the field team.
- If an accident occurs, the Field Project Manager is to complete an Accident Report Form (See Attachment B) for submittal to the managing principal-in-charge of the project.
- If a member of the field crew suffers a personal injury, the SHSO will call (901) 372-5211 or 9-911 (serious injury) to alert appropriate emergency response agencies or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.
- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the SHSO should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (See Attachment C for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through Material Safety Data Sheets (MSDS) in Attachment A.

10.0 FORMS

The following forms will be used to implement this Health and Safety Plan:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

The Plan Acceptance Form will be filled out by all employees working on the site before site activities begin. The Plan Feedback Form will be filled out by the Site Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Field Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Attachment B of this plan.

All completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

Voluntary Corrective Action Work Plan
SWMU 16 — Site-Specific Health and Safety Plan
Naval Support Activity Memphis
Revision: 0
January 13, 1998

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Attachment A
Material Safety Data Sheets

MSDS for BENZENE

Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: BENZENE
FORMULA: C6H6
FORMULA WT: 78.10
CAS NO.: 71-43-2
NIOSH/RTECS NO.: CY1400000
COMMON SYNONYMS: BENZOL; PHENYL HYDRIDE; COAL NAPHTHA
PRODUCT CODES: 9156, 9256, 9153, 9154, 9155, B717, 9149
EFFECTIVE: 01/22/87
REVISION #04

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 4 EXTREME (CANCER CAUSING)
FLAMMABILITY - 3 SEVERE (FLAMMABLE)
REACTIVITY - 0 NONE
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B
EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER

EXTREMELY FLAMMABLE

CAUTION: CONTAINS BENZENE, CANCER HAZARD

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN

EXCEPTIONAL HEALTH HAZARD - READ MATERIAL SAFETY DATA SHEET

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
BENZENE	90-100	71-43-2

3 - PHYSICAL DATA

MSDS for BENZENE

Page 2

BOILING POINT: 80 C (176 F) VAPOR PRESSURE (MM HG): 74.6

MELTING POINT: 6 C (43 F) VAPOR DENSITY (AIR=1): 2.77
SPECIFIC GRAVITY: 0.88 EVAPORATION RATE: N/A
(H2O=1) (BUTYL ACETATE=1)
SOLUBILITY (H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100
APPEARANCE & ODOR: CLEAR COLORLESS LIQUID HAVING CHARACTERISTIC AROMATIC ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP: -11 C (12 F) NFPA 704M RATING: 2-3-0
FLAMMABLE LIMITS: UPPER - 8.0 % LOWER - 1.3 %
FIRE EXTINGUISHING MEDIA
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED
BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.
MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER
TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK.
CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG
OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

THIS SUBSTANCE IS LISTED AS ACGIH SUSPECT HUMAN CARCINOGEN, NTP HUMAN
CARCINOGEN, IARC HUMAN CARCINOGEN (GROUP 1). ACCEPTABLE MAXIMUM PEAK ABOVE
THE ACCEPTANCE CEILING CONCENTRATION FOR AN EIGHT-HOUR SHIFT = 50 PPM FOR
10 MINUTES; (PEL) CEILING = 25 PPM.

THRESHOLD LIMIT VALUE (TLV/TWA): 30 MG/M3 (10 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 75 MG/M3 (25 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 30 MG/M3 (10 PPM)

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 4894
LD50 (ORAL-MOUSE) (MG/KG) - 4700
LD50 (IPR-RAT) (MG/KG) - 2.9
LC50 (INHL-MOUSE-7H) (PPM) - 9980

MSDS for BENZENE

Page 3

CARCINOGENICITY: NTP: YES IARC: YES Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

INHALATION MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS,
SUFFOCATION, LOWER BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM DEPRESSION.
INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OR BURNS OF THE

RESPIRATORY SYSTEM, PULMONARY EDEMA, OR LUNG INFLAMMATION.
LIQUID MAY BE IRRITATING TO SKIN AND EYES. PROLONGED SKIN CONTACT MAY
RESULT IN DERMATITIS. EYE CONTACT MAY RESULT IN TEMPORARY CORNEAL DAMAGE.
INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS, GASTRO-
INTESTINAL IRRITATION, BLURRED VISION, LOWERING OF BLOOD PRESSURE.
IRREVERSIBLE INJURY TO BLOOD FORMING TISSUE MAY RESULT FROM CHRONIC
LOW LEVEL EXPOSURE.

TARGET ORGANS

BLOOD, CENTRAL NERVOUS SYSTEM, EYES, SKIN, BONE MARROW,
RESPIRATORY SYSTEM

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

ROUTES OF ENTRY

INGESTION, INHALATION, EYE CONTACT, SKIN CONTACT, ABSORPTION

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR
AT LEAST 15 MINUTES.

6 - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, SULFURIC ACID, NITRIC ACID

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK
IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP
WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO

MSDS for BENZENE

Page 4

CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED
FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER:

U019 (TOXIC WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS ABOVE 10 PPM, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

SPECIAL PRECAUTIONS
BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	BENZENE (BENZOL)
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1114
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	BENZENE
HAZARD CLASS	3.2
UN/NA	UN1114
LABELS	FLAMMABLE LIQUID

MSDS for TOLUENE

Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: TOLUENE
FORMULA: C6H5CH3
FORMULA WT: 92.14
CAS NO.: 108-88-3
NIOSH/RTECS NO.: XS5250000
COMMON SYNONYMS: METHYLBENZENE; PHENYLMETHANE; TOLUOL
PRODUCT CODES: 9472, 9456, 9466, 9462, V963, 9351, 9460, 9457, 9459, 9336, 5375, 9461
EFFECTIVE: 09/08/86
REVISION #02

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 2 MODERATE
FLAMMABILITY - 3 SEVERE (FLAMMABLE)
REACTIVITY - 0 NONE
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; .4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

WARNING
FLAMMABLE

CAUSES IRRITATION

MAY BE FATAL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
TOLUENE	90-100	108-88-3

3 - PHYSICAL DATA

BOILING POINT: 111 C (232 F) VAPOR PRESSURE(MM HG): 22

MSDS for TOLUENE

Page 2

MELTING POINT: -95 C (-139 F) VAPOR DENSITY(AIR=1): 3.2

SPECIFIC GRAVITY: 0.87
(H2O=1)

EVAPORATION RATE: 2.24
(BUTYL ACETATE=1)

SOLUBILITY (H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID WITH BENZENE-LIKE ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 4 C (40 F) NFPA 704M RATING: 2-3-0

FLAMMABLE LIMITS: UPPER - 7.1 % LOWER - 1.2 %

FIRE EXTINGUISHING MEDIA

USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTANCE CEILING CONCENTRATION FOR AN EIGHT-HOUR SHIFT = 500 PPM FOR 10 MINUTES. (PEL) CEILING = 300 PPM.

THRESHOLD LIMIT VALUE (TLV/TWA): 375 MG/M3 (100 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 560 MG/M3 (150 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): MG/M3 (200 PPM)

TOXICITY:	LD50 (ORAL-RAT) (MG/KG)	-	5000
	LD50 (IPR-MOUSE) (MG/KG)	-	1.12
	LD50 (SKN-RABBIT) (G/KG)	-	14
	LC50 (INHL-MOUSE-8H) (PPM)	-	5320

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

MSDS for TOLUENE

Page 3

EFFECTS OF OVEREXPOSURE

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL. INHALATION MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, SUFFOCATION, LOWER BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM DEPRESSION. INHALATION OF VAPORS MAY CAUSE COUGHING, CHEST PAINS, DIFFICULTY BREATHING, OR UNCONSCIOUSNESS.

LIQUID MAY BE IRRITATING TO SKIN AND EYES. PROLONGED SKIN CONTACT MAY RESULT IN DERMATITIS. EYE CONTACT MAY RESULT IN TEMPORARY CORNEAL DAMAGE. INGESTION MAY CAUSE HEADACHE, NAUSEA, VOMITING, GASTROINTESTINAL IRRITATION, UNCONSCIOUSNESS, CONVULSIONS. CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

TARGET ORGANS

CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, SKIN

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY

INHALATION, ABSORPTION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

6 - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, NITRIC ACID, SULFURIC ACID, CHLORINE

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED FOR SPILLS OF THIS PRODUCT.

MSDS for TOLUENE

Page 4

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER:

U220 (TOXIC WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 1000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	TOLUENE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1294
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	TOLUENE
HAZARD CLASS	3.2
UN/NA	UN1294
LABELS	FLAMMABLE LIQUID

MSDS for XYLENES

Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: XYLENES
FORMULA: C₆H₄(CH₃)₂
FORMULA WT: 106.17
CAS NO.: 1330-20-7
NIOSH/RTECS NO.: ZE2100000
COMMON SYNONYMS: DIMETHYLBENZENE; XYLOL
PRODUCT CODES: 9489, 9499, 5377, 9491, 9493, 9490, X516, 9492, 9516
EFFECTIVE: 09/11/86
REVISION #03

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 2 MODERATE
FLAMMABILITY - 3 SEVERE (FLAMMABLE)
REACTIVITY - 0 NONE
CONTACT - 2 MODERATE

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

WARNING

FLAMMABLE

CAUSES IRRITATION

HARMFUL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
M-XYLENE	40-65	108-38-3
O-XYLENE	15-20	95-47-6
P-XYLENE	0-20	106-42-3
ETHYL BENZENE	15-25	100-41-4

3 - PHYSICAL DATA

MSDS for XYLENES

Page 2

BOILING POINT: 137 C (279 F) VAPOR PRESSURE (MM HG): 5.1

MELTING POINT: -48 C (-54 F) VAPOR DENSITY(AIR=1): 3.7
SPECIFIC GRAVITY: 0.87 EVAPORATION RATE: 0.7
(H2O=1) (BUTYL ACETATE=1)
SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100
APPEARANCE & ODOR: COLORLESS LIQUID WITH SWEET PLEASANT ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 27 C (80 F) NFPA 704M RATING: 2-3-0
FLAMMABLE LIMITS: UPPER - 7.0 % LOWER - 1.1 %
FIRE EXTINGUISHING MEDIA
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 435 MG/M3 (100 PPM)
SHORT-TERM EXPOSURE LIMIT (STEL): 655 MG/M3 (150 PPM)
PERMISSIBLE EXPOSURE LIMIT (PEL): 435 MG/M3 (100 PPM)

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 4300
LD50 (IPR-MOUSE) (MG/KG) - 1.6
LD50 (SCU-RAT) (MG/KG) - 1700

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

MSDS for XYLENES

Page 3

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.
INHALATION OF VAPORS MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF RESPIRATORY TRACT, AND LOSS OF CONSCIOUSNESS.
INHALATION OF VAPORS MAY CAUSE NARCOSIS.
CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.
INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS, GASTRO-

INTESTINAL IRRITATION, BLURRED VISION, LOWERING OF BLOOD PRESSURE.
CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

TARGET ORGANS

CENTRAL NERVOUS SYSTEM, EYES, SKIN, GI TRACT, BLOOD, LIVER AND KIDNEYS

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY

INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT, ABSORPTION

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR
AT LEAST 15 MINUTES.

6 - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK
IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP
WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO
CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED
FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER:

U239 (TOXIC WASTE)

8 - PROTECTIVE EQUIPMENT

MSDS for XYLENES

Page 4

VENTILATION:

USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET
TLV REQUIREMENTS.

RESPIRATORY PROTECTION:

RESPIRATORY PROTECTION REQUIRED IF AIRBORNE

CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP
TO 1000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH

ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES, UNIFORM, APRON, NITRILE GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	XYLENE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1307
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	XYLENES
HAZARD CLASS	3.3
UN/NA	UN1307
LABELS	FLAMMABLE LIQUID

All rights reserved.

LAST UPDATE OF THIS RECORD: 06/03/93

NAME: GASOLINE
SYNONYMS: PETROL; BENZIN (GERMAN)
CAS: 8006-61-9 RTECS: LX3300000
FORMULA: W99 MOL WT:
WLN:
CHEMICAL CLASS: Aromatic hydrocarbon; Paraffin

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: liquid; gasoline with lead may contain colored dyes, usually red, blue, green, or purple. (nydh)

BOILING POINT: 311.15-473.15 K 38-200 C 100.4-392 F

MELTING POINT: NA

38-200 C 100.4-392 F

FLASH POINT: $<227.5\text{ K}$

 $< 227.5 \text{ K}$

<-45.65 C

$\leq -50.2^\circ \text{F}$

AUTO IGNITION: 553 K

553 K

279.8 C

1027 4 F'

VAPOR PRESSURE:

UEL: 7.4 %

LEL: 1.4 %

IONIZATION POTENTIAL (eV): 6.19

VAPOR DENSITY: 3.0 (air=1)

SPECIFIC GRAVITY: 0.75

DENSITY: 0.75 g/cc or 6.975 lb/gal

WATER SOLUBILITY: INSOL

INCOMPATIBILITIES: strong ox

REACTIVITY WITH WATER: No data on water reactivity

REACTIVITY WITH COMMON MATERIALS: WITH OXIDIZING MATERIALS Source: SAX

STABILITY DURING TRANSPORT: No Data

NEUTRALIZING AGENTS: No data

POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: None reported other than possible unburned vapors

ODOR DETECTED AT (ppm): Unknown

ODOR DESCRIPTION: No data

100 % ODOR DETECTION: No data

REGULATIONS

DOT hazard class: 3 FLAMMABLE LIQUID
DOT guide: 27
Identification number: UN1203
DOT shipping name: Gasoline
Packing group: II

Label(s) required: FLAMMABLE LIQUID
Special provisions: B33,T8
Packaging exceptions: 173.150
on bulk packaging: 173.202
Bulk packaging: 173.242
Quantity limitations-
Passenger air/rail: 5 L
Cargo aircraft only: 60 L
Vessel stowage: E
Other stowage provisions:

STCC NUMBER: 4908178, 4908177

CLEAN WATER ACT Sect.307:No
CLEAN WATER ACT Sect.311:No
CLEAN AIR ACT: Not listed
EPA WASTE NUMBER: D001
CERCLA REF: Not listed
RQ DESIGNATION: Not listed
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:

Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: adverse effect to target organ
after long period of exposure.
Fire hazard: combustible.
Chronic toxicity: carcinogen

UNITED STATES POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution
wear self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all
temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - September 1989

GASOLINE [8006-61-9]

Massachusetts Substance List.

New Jersey Right To Know Substance List. (December 1987)

HA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
RA Hazardous Waste

----- TOXICITY DATA -----

SHORT TERM TOXICITY: INHALATION: nose and throat irritation have been reported after exposure to 900 ppm for 1 hour. drowsiness, dizziness, nausea and numbness may occur at 1,000 ppm after 15 minutes exposure. in animal studies, death occurred after 30,000 ppm for five minutes. SKIN: may cause itching and burning of the skin and after a longer exposure, redness and blistering. Eyes: moderate irritation of the eye has been reported after one hour exposure to 500 ppm. mild irritation has been reported after an 8 hour exposure to 140 ppm. INGESTION: gasoline causes a burning sensation in the mouth, throat and stomach. vomiting, diarrhea, drowsiness and intoxication may follow. as little as 3 to 4 ounces may be fatal. inhalation of liquid gasoline into the lungs following ingestion or vomiting may result in an accumulation of fluid in the lungs, rapid breathing or death. (NYDH)

LONG TERM TOXICITY: continuous 8 hour exposure to 200 ppm has resulted in eye irritation only. long term exposure may produce fatigue, muscle weakness, nausea, vomiting and abdominal pain. hexane, a component of gasoline, can produce nerve damage resulting in tremors, numbness of hands and feet and loss of muscle control. benzene, also a gasoline component, has been linked to blood disorders in man, including leukemia. lead additives can produce nausea, cramps, loss of appetite, sleep problems, headaches and agitation. (NYDH)

TARGET ORGANS: CNS, skin, eyes, liver

SYMPTOMS: INGESTION CAUSES INEBRIATION, VOMITING, VERTIGO, FEVER, DROWSINESS, CONFUSION, CYANOSIS; ASPIRATION CAUSES BRONCHITIS OR PNEUMONIA. INHALATION CAUSES INTENSE BURNING IN THROAT AND LUNGS; POSSIBLY BRONCHOPNEUMONIA. Source: MI10

CONC IDLH: Nonegiven

NIOSH REL: Potential occupational carcinogen

ACGIH TLV: TLV = 300ppm(900 mg/M3)

ACGIH STEL: STEL = 500 ppm(1,500 mg/M3)

OSHA PEL: Final Rule Limits:
TWA = 300 ppm (900 mg/M3)
STEL = 500 ppm (1500 mg/M3)

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC
to be possibly carcinogenic to
humans, but having (usually) no
human evidence.

MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-man TCLO:900 ppm/1H JIHTAB 25,225,43
SENSE ORGANS

Eye

Conjunctive irritation

BEHAVIORAL

Hallucinations, distorted perceptions

LUNGS, THORAX, OR RESPIRATION

Cough

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

ihl-rat LC50:300 gm/m3/5M
ihl-mus LC50:300 gm/m3/5M
ihl-gpg LC50:300 gm/m3/5M
ihl-mam LCLO:30000 ppm/5M

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED

FROM THE CHRIS MANUAL:

FIRST AID SOURCE: DOT Emergency Response Guide 1990.

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: Gasoline

DOT ID NUMBER: UN1203

ERG93

GUIDE 27

POTENTIAL HAZARDS

*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames. Vapors may travel to a source of ignition and flash back. Container may explode in heat of fire. Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Material may be transported hot.

*HEALTH HAZARDS

be poisonous if inhaled or absorbed through skin. vapors may cause dizziness or suffocation. Contact may irritate or burn skin and eyes. Fire may produce irritating or poisonous gases. Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas.

Positive pressure self-contained breathing apparatus (SCBA) and structural firef
*Isolate for 1/2 mile in all directions if tank, rail car or tank truck is invol
CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping P
If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

Apply cooling water to sides of containers that are exposed to flames until well
For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if
Withdraw immediately in case of rising sound from venting safety device or any d

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.

Stop leak if you can do it without risk.

Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and

Large Spills: Dike far ahead of liquid spill for later disposal.

***FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration. In case of contact with material, immediately flush eyes with running water. Remove and isolate contaminated clothing and shoes at the site.

DISCLAIMER: The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement. The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.

Attachment B

Health And Safety Plan Forms

PLAN ACCEPTANCE FORM

SITE HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project work site and returned to the Site Manager, EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: 0094-29000

Contract No: N62467-89-D-0318

Project: SWMU 16 — N-94 Aboveground Waste Storage Tanks

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it. I certify I am in compliance with the applicable OSHA training requirements pertaining to the following:

Check all that apply

- ☐ 40-hour HAZWOPER training per 29 CFR 1910.120 (required)
- ☐ 8-hour HAZWOPER Refresher per 29 CFR 1910.120 (required; if applicable)
- ☐ 8-hour HAZWOPER Site Supervisor per 29 CFR 1910.120 (required; if applicable)
- ☐ First Aid (if applicable)
- ☐ CPR (if applicable)

Signed

Print Name

Company

Date

地址：上海南京路100号 电话：021-23112222

Job Name: _____

Hours Onsite: _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

Figure 1. The effect of the number of trials on the mean accuracy of the responses ($n = 10$)

Attachment C

Directions to Emergency Medical Facilities

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

The nearest hospital and the nearest facility capable of treating chemical burns are the same facility, which is Methodist North Hospital. Therefore, there is only one set of directions.

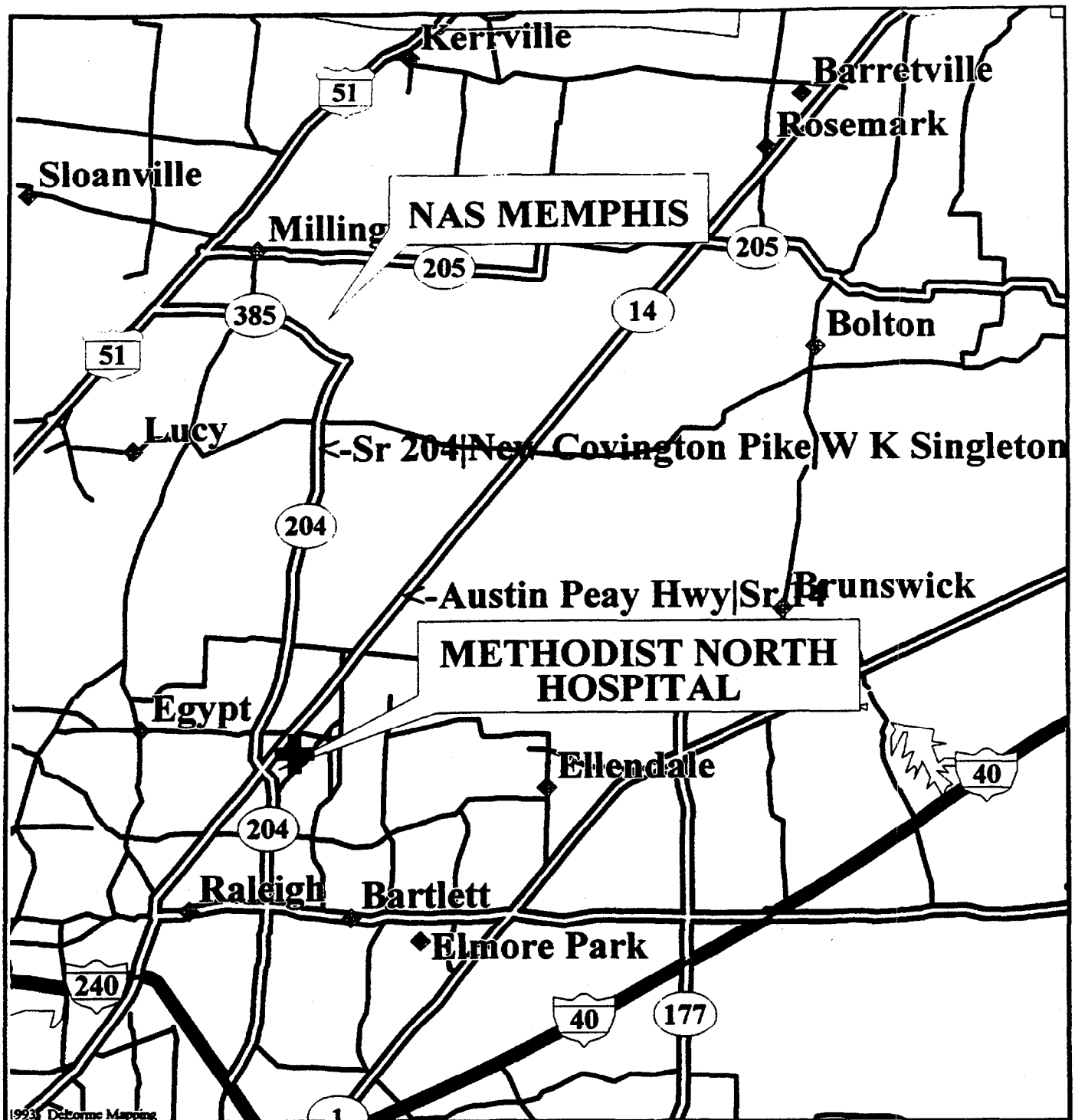
Nearest Hospital

**Methodist North Hospital
3960 Covington Pike
Memphis, Tennessee**

Emergency Room Telephone Number - (901) 372-5211

Directions to Methodist North Hospital from NSA Memphis Main Gate:

- 1) Exit site through South Gate (Singleton Parkway).
- 2) Continue on Singleton Parkway through the stop signs.
- 3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).
- 4) You will see the entrance to the emergency room 700 feet past this light on the left.



HEALTH & SAFETY PLAN
NAS MEMPHIS
MILLINGTON, TN

DIRECTIONS TO THE HOSPITAL

DWG DATE: 10/04/94 | DWG NAME: BOARD